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The Motors Are Mounted on Each Side of the Driving Wheels.

The Cars Run on Tandem Trucks and Overhead Guides Keep Them from Toppling Over.

THE TUNIS MONORAIL SYSTEM.—[See page 108.]

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NEW YORK, SATURDAY, FEBRUARY 15, 1908.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

SOUTHWEST PASS JETTIES OF THE MISSISSIPPI COMPLETED.

The completion of the great jetties at the mouth of the southwest pass of the Mississippi River provides the South with one of the deepest harbors in the world; for the lower Mississippi River is not only broad but exceedingly deep, and provides excellent harbor accommodation for ships of the largest size.

The new jetties, upon which the United States government is spending some $6,000,000, were commenced some four years ago. They are larger and more substantially built than the better-known jetties at the Mississippi's South Pass, which now, for over thirty years, have formed the main entrance to the river. The new jetties, one of which is about three and the other about four miles in length, form two approximately parallel walls with about half a mile of distance between them. They have been built for the purpose of giving sufficient acceleration to the current of the river to enable it to cut through a bar of mud some three miles in width, and produce a channel with a width of 1,000 feet and a least depth of 35 feet. Even before the completion of the jetties, they had done their work so well that the scour of the current had cut away the bottom, until in some places, where, when the work was commenced, there was not more than 8 or 10 feet, there exists to-day from 50 to 80 feet of water. The jetties have been built by the well-tried method of sinking mattresses of willow and constructing upon this foundation walls of broken rock which, in the present case, are capped with a concrete sea wall 4½ feet in height.

Observation of the rate of growth of the bar at the mouth of the river during the past seventy years, shows that it has steadily extended seaward at the rate of from 150 to 250 feet annually. In all probability the bar will continue to grow beyond the mouth of the jetties; but, because of the preventive work which has been done by the government on the Mississippi River itself, it is not likely that the future rate of growth will be nearly so rapid. Should a new bar form, it can be cut through by the simple plan of extending the present jetties.

PROGRESS OF THE KEY WEST RAILROAD.

The recent dispatch of a train from Miami, Florida, to Knights Key marks the completion of the greater part of the remarkable transmarine railroad which is under construction from the mainland of Florida to Key West. The entire line from Miami to Key West, when completed, will extend for a distance of 156 miles, and the remarkable feature of the construction is that about one-half of the line is built over the open sea, involving an enormous amount of embankment and bridging. The practical value of the road will be due to the fact that it will shorten the present time of passage from Cuba to Miami by ten hours, and from Cuba to Tampa by twelve hours. For the present the terminus of the road will be at Knights Key, from which point steamers will sail for both Havana and Key West; so that even in the present incomplete condition of the road the United States will be brought into much closer touch with Cuba than has hitherto been possible. The Florida Keys, over which the railroad has been constructed, consist of a gently curving line of small islands, most of which are uninhabited, although some of them are high and dry at all seasons of the year. Although the shallow nature of the intervening stretches of the water has been favorable to bridge construction, the exposed character of the location has rendered the work of construction difficult and at times perilous.

THE LAST OF THE CABLE ROADS.

The abandonment of cable traction on the Brooklyn Bridge marks the close of the era of a system of traction which gave most excellent service in the past twenty-five years in many of the important cities of this country. The introduction of cable traction commenced about a quarter of a century ago, at a time when the electric car was in its comparative infancy and had not been developed to the point at which it was capable of being intrusted with the operation of those large city traction systems to which the cable was so rapidly applied. No more striking tribute could have been offered to the excellence of cable traction than the fact that it should have survived as long as it did after the successful introduction of electricity. It proved to be particularly serviceable in cities such as San Francisco, where the grades were so steep as to prohibit the use of electric traction in its then undeveloped condition. One of its chief drawbacks, at least as far as New York was concerned, was the frequency of accidents to the cable and the long delays which were often necessitated in making repairs.

On the Brooklyn Bridge the cable remained in use for nearly a dozen years after it had been superseded on practically every other road to which it had been applied; but conditions on the bridge were such as to offer special reasons for its continued operation. The long and heavy grades on the bridge approaches were conducive to the economy of cable operation, for the reason that the trains which were running on the down grade furnished a large part of the power necessary to haul the trains that were ascending the opposite grade. Moreover, the cable system made it possible to accurately space the trains and so eliminate the danger of rear collision. When the cable service was installed the trains to be handled were very much heavier than the comparatively light cars in use at that time on surface roads, and it became necessary to design an entirely new method of grips and other apparatus for connecting and disconnecting the trains from the cable. The success with which this was done is shown by the fact that for twenty-four years cable haulage has been successfully operated on the Bridge, under conditions of traffic more severe than exist on any other road in the world; and the service has been maintained throughout that long period with comparatively little interruption. Late improvements in electric traction have rendered it possible for heavy cars to climb the steepest grades with such certainty and speed that the cable has outlived its usefulness, even on the Brooklyn Bridge.

MORE BLOCK SIGNALS; FEWER ACCIDENTS.

It is a welcome relief, after so much chronicling of increasing statistics of railroad accidents, to be able to state that one of our largest railroad systems has succeeded in reducing its accident list by nearly sixty per cent. The Union Pacific officials have published statistics in their recent annual report, which show that the number of people killed and injured on their road during the last year was 1,209 as compared with 2,097 in 1906.

This is considered to result largely from the $12,000,000 that the Harriman lines have spent for track signals and appliances on rolling stock during the last six years, the expenditures for this purpose in 1907 amounting to $2,000,000. To make its block signal and other systems more effective the company constantly conducts surprise tests, to try the watchfulness and faithfulness of its employees in the observance of signals. Every operating official, from the highest to the lowest, is compelled to make a number of these tests every month, the total reaching several thousand for all the lines involved. A traveling school of instruction has recently been going over the roads, drilling new and old employees and examining them as to their familiarity with the rules of the company.

The decrease of accidents in 1907 is all the more significant in view of the fact that the Union Pacific shows an increase of 2.66 per cent in tons of freight carried one mile, nearly 13 per cent in passengers carried one mile, more than 10 per cent in the total train mileage, and nearly 6 per cent in the total car mileage. In the last year the total number of employees killed on the Union Pacific system was 66 and the injured 859, out of a total of 27,000 men. The killed and injured list in the previous year footed 1,823. By the end of 1907 the Harriman lines had a total of about 5,000 miles of double and single track equipped with automatic block signals, a larger mileage so equipped than exists on any other railroad in the world. This year is expected to show a still further decrease in the number of accidents as the result of extension of the company's block signal installations, its care in instructing employees, and the methods adopted to secure strict observance of orders designed to safeguard passengers and trainmen.

We are of the opinion that the frightful casualty list on American railways is due as much to lack of discipline as to any other cause. The chief engineer of one of our leading railroads recently made a tour of the European railroads to study the question of safety of travel, examine the signal systems, and ascertain the true secret of the remarkable immunity of foreign railways from accidents. Upon his return, he informed us that he was surprised to find apparatus in use on some English roads that was decidedly inferior to that in use on his own system, and yet those roads had been running for years with practically no accidents of fatal or serious character—and this in spite of the fact that the traffic was exceedingly heavy. He attributed these results to the perfect discipline of the operating staff, and expressed the conviction that while much might be done in the United States to reduce accidents by the installation of better safety apparatus, travel would never be equally safe on our railways until our discipline was brought up to the high European standard. We believe that just here, in the lax discipline and continually-changing operating force, is to be found the fruitful cause of the dangers of railroad travel. Better safety appliances will do much, as the Union Pacific statistics prove; but unless the officials have absolute control over their men—a control that is free from the menace of interference by the unions—we shall continue to hold the unenviable distinction of wounding and killing a larger percentage of the passengers on our railroads than any other country.

PRECAUTIONS AGAINST ANTHRACITE MINING ACCIDENTS.

In view of the recent disastrous accidents in bituminous coal mines, and the call for further investigation into the causes and means of prevention of such accidents, it is of great interest to note what elaborate precautions are taken to protect the anthracite mines of Pennsylvania against similar disasters. It is gratifying to learn that statistics gathered by the Pennsylvania Department of Mines show that accidents are decreasing in number and seriousness. Disasters which result from carelessness on the part of the miners themselves, it is, of course, impossible to avoid, even by the most carefully-drawn restrictions, and according to official State reports, this class of accidents is greater than any other. We are told that the State of Pennsylvania employs as many inspectors to look out for her mines as are employed in all England, Scotland, and Wales, and, with a view to supplementing the State regulations, the anthracite-mining companies encourage the knowledge and practice of protective measures among the miners by instituting competitive examinations. The Delaware, Lackawanna & Western collieries, for example, have been divided into four districts, in each of which examinations are carried out separately. Every mine foreman and the various "bosses" are expected to have the State laws and the company's rules at their tongues' end; and the examination is held by a board consisting of the general manager, his assistant, and the chief engineer. The answers of each man are marked for relative merit, a handsome trophy is awarded to the district which makes the highest average, and the district that wins three times in succession keeps the trophy.

Another instance of the care taken to prevent accidents is the testing of mine elevators. The shafts vary in depth from 200 to 2,000 feet. The test consists in dropping a loaded elevator, to make sure that all the safety catches are in good working order. The cage is first loaded to its full capacity, and is then suddenly released. It drops only a short distance, for the powerful catches grip the guides tighter and tighter until the cage comes to a stop. Official reports of the tests are filed for reference and examination by the State mine inspectors. The cables supporting the elevators vary in size with the depth of the shaft. The usual diameter is an inch and a quarter or an inch and a half. Long before the wire ropes begin to show signs of wear, they are replaced by new ones. Last year one of the large companies spent $70,000 for new ropes.

Chemical fire engines have been introduced for fighting fire in the anthracite mines. The engines are built upon trucks, which can be run into any part of a mine. Several hours before the men start to work, the fire bosses go through the subterranean corridors to look for any sign of fire, gas, or other danger. This is a duty as fixed as the mining of coal itself, and only a man of long experience is allowed to become a fire boss. Powerful fans, working day and night, keep the mines well ventilated. The development of these fans has been a most important agency in preventing fatal accidents. The stranger who is taken down into an anthracite mine is invariably surprised at finding the air as fresh as it is on the surface.

A comparatively new innovation—one that means a great deal to the miners—is the First Aid to the Injured Corps. These have been established in a large number of anthracite mines. They are formed of volunteers among the young men of the mines.

instructed at first by physicians, they render themselves efficient by continual practice. At the bottom of each main mine shaft is a sort of emergency hospital. Here are kept splints and bandages and stretchers. At the first news of an injury, men with stretchers and splints run to the victim, and help him according to approved first-aid-to-the-injured methods. When he is properly bandaged, they put him on a stretcher and carry him to the elevator. From the top of the shaft an ambulance takes him to the nearest hospital or to his home.

These are only a portion of the precautions taken by the anthracite mine owners and the miners to prevent accidents. There are dozens of rules, which are enforced by both State officers and officers of the companies, and penalties are inflicted for breaches of the rules. The efficiency of all these preventive measures, however, will always be largely measured by the degree of co-operation shown by the miners themselves. This is suggested by the report of the chief of the Pennsylvania Department of Mines, which states that 58 per cent of the accidents are due to negligence, carelessness, recklessness, and ignorance on the part of the victims.

TURBINES IN THE UNITED STATES NAVY.

Though Navy Department officials at Washington have so far refused to declare themselves, as have the naval authorities in England and France, in favor of the exclusive use of turbine propulsion for warships, in place of the reciprocating engines, yet the United States navy is by no means backward in their use on ships now under construction. The policy of the department has been against making a decision toward adopting turbine engines, until actual tests have demonstrated their superiority. With a view to carrying out such comparative tests, and to determine conclusively the relative merits of the reciprocating engines and of the two types of marine turbines, it was decided to make test installations in the three 3,750-ton scout cruisers authorized by Congress in 1904. One, the "Chester," accordingly is fitted with turbines of the Parsons type built in this country from plans purchased in England. The second scout cruiser, the "Salem," is fitted with the Curtis type turbines developed in this country, but as yet practically untried for marine work; and the third, the "Birmingham," has triple-expansion reciprocating engines. These ships, it is expected, will be completed and tried during the coming year, and the navy then will be in possession of reliable, first-hand information regarding the capabilities of turbines. Up to the present time it has been able to procure information on this subject only from reports in the press.

The Parsons type of turbines have been adopted exclusively by the English Admiralty and recently by the French Ministry of Marine. A number of English ships have been fitted with them, the most important the battleship "Dreadnought." Though optimistic reports of the performance of the "Dreadnought's" turbines have been given out, it is known that the results have been by no means satisfactory. The Navy Department rejected the offers of bidders proposing to fit the Parsons turbines in the last battleships put in hand, the "South Dakota" and "Delaware," but accepted Curtis turbine installation for one of them. Parsons turbine installations on these ships would have cost more, and would have required a rearrangement of the engine-rooms and possibly of one of the turrets. These considerations, added to the failure of the bidders to guarantee a smaller consumption of steam except at high speed than for the reciprocating engines, contemplated in the bid, no doubt contributed to the refusal to adopt Parsons turbines for the other one of the battleships of the class.

The five 800-ton torpedo-boat destroyers, however, for which the contracts have just been let, are to have the Parsons turbines, in spite of the fact that their use involved increasing the displacement and length of the boats, originally designed for reciprocating engines. While such action seems illogical on the part of the authorities, in view of their refusal to accept Parsons turbines on battleships, it may be justified by the greater speed of the destroyers made possible with the turbines, the absence of vibration, so objectionable in previous torpedo craft, and the increased ease in operating the engines. Another consideration is that high speed of revolution of propellers of small diameter in a torpedo boat is not as wasteful in power as would be the case for the large-diameter propellers in a battleship, revolving at the same relative high speed.

Turbines of the Curtis type, developed and built in this country, as noted above, are to be fitted on two vessels under contract for the navy, the scout cruiser "Salem" and battleship No. 29, the "South Dakota." Although practically untried for marine purposes, these turbines have proved most efficient for use on land for driving electric generators. Just before the opening of the bids for the battleships No. 28 and No. 29, a new merchant ship equipped with Curtis turbines made a successful trial trip, the results of which, coupled with the fact that the bid that contemplated fitting the Curtis turbines on one of the ships was next to the lowest received, impelled the Navy Department to accept this bid, although as above noted, bids offering Parsons turbines were rejected. A consideration that must have influenced the decision to fit one of the battleships with Curtis turbines is the construction in this country, for the Japanese government, of two sets of these turbines, one for a battleship and one for a cruiser.

The recent feat of the "Lusitania" in breaking the transatlantic record, is attributed to the use of Parsons turbine engines; and while they undoubtedly rendered this possible, it must be remembered that in a merchant ship the considerations of weight and space occupied are not of prime importance, but speed and absence of vibration are entirely so.

Battleships ordinarily are not forced to steam at full speed, and the necessity for economizing fuel requires that a lower, or cruising speed be provided for. On warships having Parsons turbines a special smaller "cruising turbine" therefore is fitted, and needless to say, it adds considerably to the expense, while making the arrangement unwieldy and complicated. It is claimed for the Curtis turbine that it operates at slower speeds nearly as efficiently as at higher speeds, thus doing away with the necessity of "cruising turbines."

There are to be found, however, so many objections to both types of turbines for warship propulsion that experts generally agree that the day of turbine engines in this country's warships will not come until another type offering fewer disadvantages has been evolved.

MINE BLASTING INVENTION.

Consul Frank W. Mahin, of Nottingham, advises that a check weigher at the South Normanton coal mine in Derbyshire, England, has invented a method of blasting which is claimed to much reduce the liability of accidents by insuring the firing of every charge. Its need and method of using are thus reviewed by the consul:

Official reports for 1906 show 281 accidents from blasting operations in England during the year, causing 43 deaths and injuries to 312 persons. It is claimed that nearly half of these accidents, deaths, and injuries could have been prevented by the use of this invention, which is thus described: The end of a tube with a loose central needle is inserted into a cartridge of explosive material, and the cartridge with the tube and needle are placed in the prepared shot hole. The hole is then rammed, after which the needle is withdrawn from the tube, and the detonator, attached to a suitable carrier, is then passed through the tube into the space left in the explosive by the withdrawal of the needle.

The detonator is coupled to the battery and fired; but if from any cause the explosive is not fired, or the detonator misses fire, it can be withdrawn and another detonator attached to the carrier and placed to the explosive, as in the first case. This method, it is claimed, places within the bounds of possibility the safe control of these detonators, which have been a menace to the lives of miners, as well as to the general public. They can be placed in charge of officials and kept from the workmen, and in case of "miss-fires" they can be returned to the makers or destroyed by means provided for that purpose.

THE USE OF THE LUMIÈRE SYSTEM OF COLOR PHOTOGRAPHY IN MEDICINE.

In a lecture recently delivered before the Berlin Medical Society, Prof. C. Benda drew attention to the value of the Lumière process of color photography to the medical profession, and pointed out that the results it will lead to are essentially original. This process allows for the first time the natural colors of an object to be rendered with faithfulness by a method readily accessible to any photographer, and which hardly requires any more time than ordinary photographic operations, while the material used in this connection, though more expensive than ordinary plates, by no means involves any excessive outlay.

After describing in detail the technicalities of the process, Prof. Benda demonstrated a set of plates illustrating the possible applications of the process to medical instruction and to the demonstration of microscopical objects and samples of pathological anatomy. In the field of micro-photography the author has given special attention to such objects as do not lend themselves to direct micro-projection, viz., in the case of considerable magnification, and especially to those which cannot be rendered perfectly by ordinary photographic methods, either owing to their double colors or to their delicate shades. He demonstrates the efficiency of the method by his records relating to blood pathology, to tryanosomes, and malaria parasites. Even objects so susceptible as spirothetes are readily photographed by the process. However, in the case of high magnification it is recommended to use very thin cross sections.

As typical instances of applications to microscopic photography the author chose a limited number of samples relating to pathological anatomy, including some brains. Whereas in the case of organic cross sections any reflexes due to shining surfaces should usually be avoided, such reflexes (in opposition to what may be said in the case of ordinary photography) are especially adapted to enhance the plastic appearance of a color picture.

EXPOSITION OF SAFETY DEVICES.

Announcement has just been made that an exposition of two months will be held early in April in New York, under the auspices of the American Museum of Safety Devices and Industrial Hygiene, for showing the best methods of safeguarding wage earners and protecting the general public. The exhibits will consist of safety devices, protected machinery in actual operation, models, and photographs. During the exposition illustrated lectures by engineers will explain industrial conditions and hazardous occupations and the most approved methods of safety. There will be no charge for space.

Believing that many accidents are preventable, and to stimulate further invention, gold medals are offered for the best safety devices in the fields of transportation, mining, motor vehicles, and motor boats. Two prizes of $100 each, one for the best essay on "The Economic Waste Due to Accidents," the other on "The Economic Waste Due to Occupational Diseases," are offered. The SCIENTIFIC AMERICAN medal is offered for the best device in the field of transportation. It is essential that a model be exhibited at the museum. Inventors now have an opportunity of showing their devices without expense.

The chairman of the Committee of Direction is Charles Kirchhoff, and of the Committee of Exhibits, Prof. F. R. Hutton. All inquiries and applications for space should be made to Dr. W. H. Tolman at the museum, 231 West 39th Street, New York city.

A meeting was held February 11, 1908, at Cooper Union, New York, for the expression of opinions as to "Safety for American Life and Labor." The Rt. Rev. H. C. Potter presided, and among the speakers were the Hon. Carroll D. Wright, the Rev. Percy Stickney Grant, Rabbi Stephen S. Wise, and others.

THE CURRENT SUPPLEMENT.

Of the many industries that occupy important places in American life, there are few of which the public are so ignorant as that of the manufacture of gas. The purpose of the opening article of the current SUPPLEMENT, No. 1676, is to remove this ignorance so far as possible; for it tells clearly and succinctly with the aid of excellent illustrations just how illuminating gas is made. T. L. White points out how acetylene may be used as a fuel for motors, and how the disabilities under which it has hitherto suffered are easily overcome. To produce low-priced machinery it is necessary that a large number of pieces should be made at one time. Walter J. May tells very clearly how the various parts may be cast at low cost. In the eleventh installment of his "Elements of Electrical Engineering," Prof. A. E. Watson discusses direct-current systems of distribution. The explosion of gases is made the subject of an interesting paper, in which modern discoveries are commented upon. At present there is in construction in Paris a subway line which is most interesting from the engineering standpoint. The Paris correspondent of the SCIENTIFIC AMERICAN writes upon this new line, and illustrates his text with remarkable pictures. G. Urbain contributes a paper on the new element "lutecium," which he has obtained by splitting up ytterbium. The aniline dye industry is a subject which is always of interest. For that reason Prof. William A. Noyes's contribution on the subject is published. Competition in nature is so keen that the individuals that cannot at least come up to a certain standard must soon succumb to others in the great struggle. S. Leonard Bastin describes one phase of this universal battle in an article entitled "Make-Believe Flowers." Prof. David Starr Jordan, perhaps the greatest authority in this country on fishes, writes a semi-popular article on the fishes of the deep sea. Crystallized quartz, though one of the most widespread and abundant of minerals, is much sought after by collectors on account of the varied and beautiful forms which it presents. For that reason Edgar T. Wherry's article on the formation of quartz crystals is of peculiar value.

GROWING RUBBER IN SUMATRA.

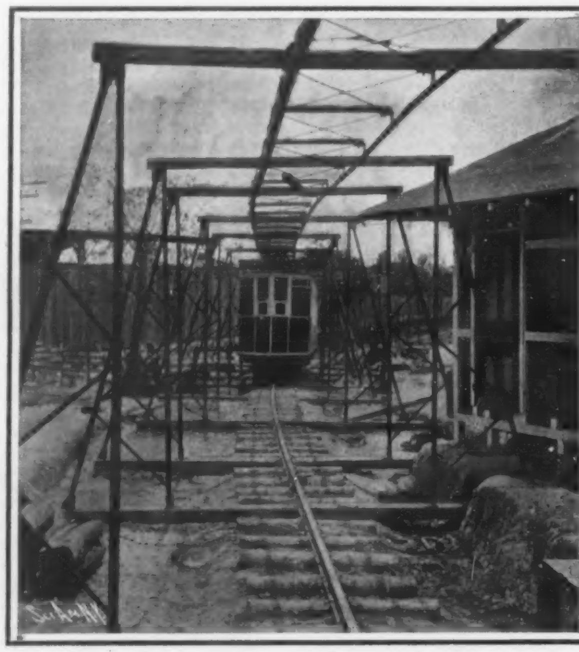
A. C. Janssens, the explorer who spent ten years in the Congo Free State, recently landed in San Francisco from the East, where for some years he has been studying rubber and its cultivation possibilities in Sumatra and the Malay Peninsula. He states that he finds the rubber industry is flourishing, both in the Peninsula and in Sumatra. Though expenses are higher in the former place, the production is very considerable, and increasing. In time this district may produce rubber sufficient to supply the world.

THE TUNIS MONORAIL SYSTEM.

Closely associated with the word "monorail" in the minds of the general public, there is doubtless a vivid picture of a huge car, a veritable hotel, balanced on a single rail by means of gyroscopes, racing at break-neck speed uphill and down, and now and then darting across a broad river or deep canyon on a slender cable. But the first monorail antedates Mr. Brennan's unique gyroscopic system by many years, and was based on principles with which engineers have long been thoroughly familiar. At the Centennial Exposition at Philadelphia, a "pack saddle" monorailroad was exhibited. The cars were bifurcated, and were mounted astride a single elevated rail. The balance was maintained by reason of the fact that the center of gravity of the cars lay below the track. Since then many other monorail systems have been invented. The Barman-Elberfeld line in Germany is an example of the suspension system, the cars being suspended from a monorail track, and it is the only monorail passenger line now in practical operation. Other monorail systems depend upon a guide rail to maintain the cars in upright position on the traction rail, and in this class belongs the monorailroad invented by Mr. Howard Hansel Tunis, which was exhibited at the Jamestown Exposition last summer. The Tunis monorail, although operated over a line scarcely half a mile long, proved to be a very popular feature of the exposition, and as a result of its success an elevated four-track high-speed monorailroad of this type from New York to Newark is now being seriously considered.

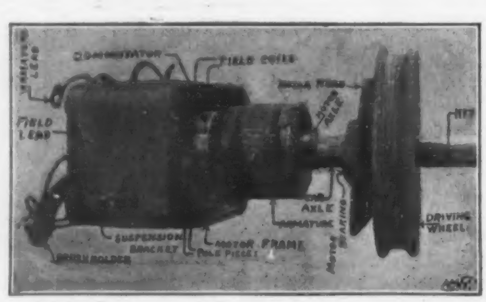
The general features of the Tunis system are shown in the accompanying engraving. The traction or driving wheels of the car are arranged in tandem, and the cars are prevented from toppling over by an overhead guide. There are four double-flanged driving wheels to each car, and each wheel is driven by two electric motors. The details of these motors and their direct connection with the driving wheels are illustrated in one of our engravings.

The overhead guide is supported by a light framework, and consists of two parallel angle rails set with the horizontal flanges facing inward. Two X-shaped trucks with wheels at the four extremities of the X are mounted above each car, and engage the angle rails. The wheels are formed with grooves, $1\frac{1}{2}$ inches deep, to receive the horizontal flanges of the angle rails, so that the trucks, though free to travel along the guides, cannot be disengaged from them either by a dragging or a lifting force. Obviously, it is impossible to maintain the car at a uniform level below the guide rail, owing to slight variations in the level of the roadbed, as well as to flexure of the car springs; hence, the overhead trucks are mounted on short arms hinged to the roof of the car, in a manner similar to a trolley pole. The arms have a wide base, and effectually prevent lateral motion of the car with respect to the guide trucks, but allow perfect freedom of motion in a vertical plane. A coil spring pressing upward against each arm serves to counterbalance the weight of the arm and truck, and thus relieves the superstructure of all unnecessary strains. On a straight track there is little lateral pressure imposed on the guide rails. The cars are almost perfectly balanced, and as the principal weight due to the heavy motors is close to the track, the guide arms and trucks are furnished with a long leverage, so that the cars may be held upright by the merest touch. When the cars are in motion, the gyroscopic action of the traction wheels will assist in holding them in a vertical plane. So slight is the pressure on the guide rails, that it is proposed in future constructions to use a catenary suspension system for supporting the overhead structure. On curves the lateral pressure will reach its maximum; but the strains will be materially reduced by leaning the cars inward to counteract the centrifugal force.



The Monorailroad at the Jamestown Exposition.

The guide rails are used as electrical conductors to supply the power necessary for running the motors. Evidently, the use of two conductors and eight guide wheels bearing upon them will provide a much larger contact surface than is possible in the ordinary trolley constructions, and it should prove a great advantage in reducing ohmic resistance. The problem of switching the cars from one track to another is an interesting one. We are informed that a number of methods of switching have been worked out, which cannot as yet be disclosed, as they are still in the hands of the Patent Office.



Details of Monorail Motor, Showing Method of Mounting on Driving-Wheel Axle.

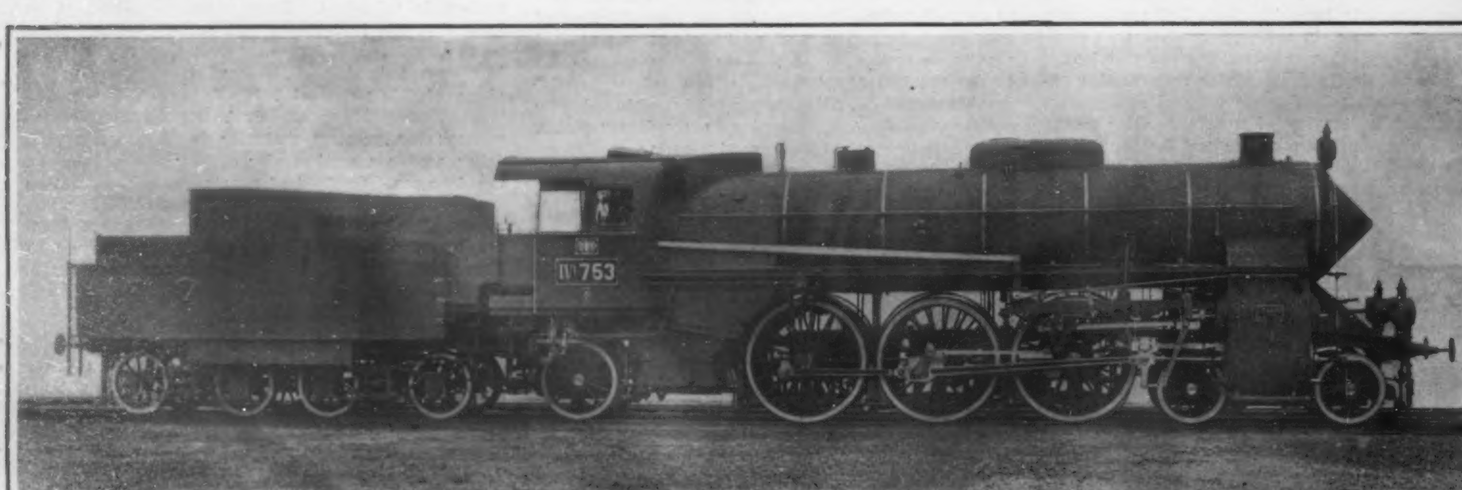
It is claimed for this monorail system that it is far cheaper than a double-rail road. The roadbed is graded to one-half the usual width, and in laying the track there is only one rail to deal with. This eliminates the difficulties of the double-rail track, in which each rail is dependent upon its fellow, both as regards gage and grade. It is a very difficult matter to preserve the two rails of a double track in absolute parallel with each other, and at exactly the same level or inclination. By doing away with this feature of the track construction, the cost of the superstructure in the monorail system will be more than offset.

The monorailroad is eminently fitted for high-speed travel, because the cars, being supported at the top as well as at the bottom, are kept very steady. We have reached the limit of speed on steam railroads. The violent rocking and swaying of the locomotive and the heavy pounding of its parts, work havoc with the track. Even with electrically-driven cars, a double track offers serious objections to high-speed travel. At the Berlin-Zossen high-speed trials a few years ago, a specially heavy and well-ballasted track was constructed; but the cars, when running over this track at speeds of 120 to 130 miles per hour, swayed heavily from side to side, and pounded badly at the joints, and developed enormous strains which, very evidently, would soon wreck the best of roadbeds. A slight depression of one of the rails is sufficient to start the car swaying, and at high speeds such swaying is not only injurious to the equipment and roadbed, but extremely dangerous to passengers as well. On the other hand, in a monorailroad of the type we have just described, the cars will have no tendency to sway, because a slight variation in the level of the rail will not result in a lateral motion, but merely in a vertical fall and rise.

A HIGH-POWER EUROPEAN LOCOMOTIVE.

BY CHARLES R. KING.

A locomotive recently built for the State Railways of Baden is probably the most powerful as yet constructed in Europe, and so is deserving of notice. The locomotive has 2,797 square feet of heating surface, generating steam with a pressure of 235 pounds per square inch and with a temperature of 570 deg. Fahr., utilized in four compound cylinders. The superheater is of the D or fire-flue type for high temperatures. The engine is of the balanced compound type, with all main rods working upon one almost perfectly balanced axle, the superheated steam being distributed by four piston valves. The constructive details of the boiler—with a wide firebox—follow the best American practice, and this with the bar-frame construction is entirely opposed to the reactionary opinions of engineers controlling the design of Prussian locomotives. Another feature to note is the method employed for connecting the inside main rods to the second driving axle. The impediment offered by the front connected axle is overcome by very considerably raising the inside cylinders and adopting a sharp inclination for the high-pressure pistons and rods. By this means all rods are contrived to drive the same pair of wheels. The crank axle is of the oblique-arm type, forged from an ingot of nickel steel of high tenacity and bored out hollow. There are no inside eccentrics to interfere with the strength of the crank webs. The inside high-pressure valves are actuated by two-armed rockers, there being only one set of valve gears for the four valves. The rockers move the valves through the same transverse planes simultaneously, consequently, while simple piston valves serve for the inside valves, triple-



The Most Powerful Locomotive Yet Built in Europe. Constructed in Bavaria for Use on the State Railways of That Country.

HIGH-POWER EUROPEAN LOCOMOTIVE.

headed double-ported valves permit of inside steam admission to the outside cylinders without resort to mechanical devices for reversing the simultaneous direction of one set of valves. A novel feature, for modern locomotives at least, is the employment of different lengths of piston stroke, the longest stroke being for the outside low-pressure cylinders. Mechanically, the engine is quite as simple as a single-expansion engine, the only added complication being that of the superheater in the boiler. To carry the valve mechanism, a special outside motion bar is introduced, supported at the front end on the valve cover, and at the back end on a beam of I section traversing the frames. The crank for driving the oil pumps, taking motion from the radius link, is carried on the outside of the motion bar. The long stem running from the reach-rod crank to the outside valve chests serves to pull back the small L-cranks on the stems of the vertical valves that are distinguishable on the low-pressure valve-chest casing, so that when the reversing gear is set to exceed a steam admission in the high-pressure cylinders of over 70 per cent, as in starting a train, the two cylindrical valves above the valve chest then open and permit superheated boiler steam to enter the low-pressure cylinders. Reduction of cut-off automatically closes the inlet valves. Water drain cocks are fitted to the cylinder, thereby indicating that highly superheated steam locomotive cylinders trap condensation water. All wheels of the locomotive are braked, the blocks on the driving wheels being disposed to reduce strain on the frame when they are applied. The general dimensions are: Cylinders, high-pressure, 16¾ inches diameter by 24 inches stroke; low-pressure, 25⅝ inches diameter by 26⅜ inches stroke; driving wheels, 70¾ inches diameter; boiler pressure, 235 pounds; inside firebox heating surface, 172 square feet; inside tube heating surface, 2,195 square feet; outside superheating surfaces, 430 square feet; total heating surfaces in contact with fire, 2,797 square feet; grate area, 48.4 square feet; weight of engine empty, 75 tons; weight loaded, 84 tons; weight on each pair of driving wheels, 15¾ tons; height of boiler center, about 9 feet 3 inches; height to top of chimney, 15 feet 3 inches; rigid wheel base, 12 feet 9 inches; and minimum radius of curves to traverse, 535 feet. The tender weighs only 21.8 tons empty, and carries 7 tons of coal and 20 tons of water. The tender trucks are of diamond pattern, the engine pilot truck having rolled plate frames, while the engine main frame is of bar type from end to end, without recourse to any form of mixed plate and bar construction.

The locomotive is required to work heavy gradients ranging from 16.7 to 20 per thousand, 22 miles in length, and on light grades of 1 in 300 to pull 300 tons and maintain a speed of 62 miles per hour.

According to a contemporary, a cement that will resist white heat may be made of pulverized fireclay 4 parts, plumbago 1 part, iron filings or borings free from oxide 2 parts, peroxide of manganese 1 part, borax ½ part, and sea salt ½ part. Mix these to a thick paste, and use immediately. Heat up gradually when first using.

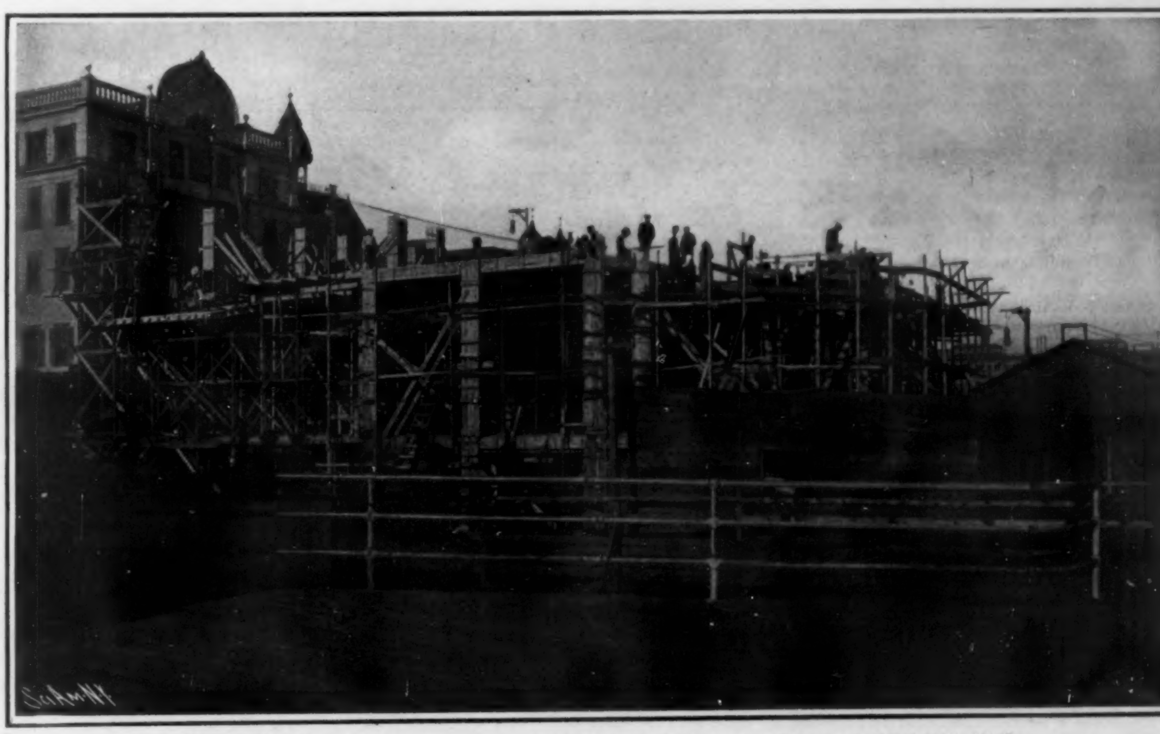
The English Mechanic gives the following recipe for a compound good for cleaning paint on engines: To 1 gallon of water add ¼ pound of borax and ½ pint of lard oil. Rub this upon the paint to be cleaned, then wipe off with clean waste or soft cloth. The wiping off must be done before the mixture dries.

A REINFORCED CONCRETE HOTEL.

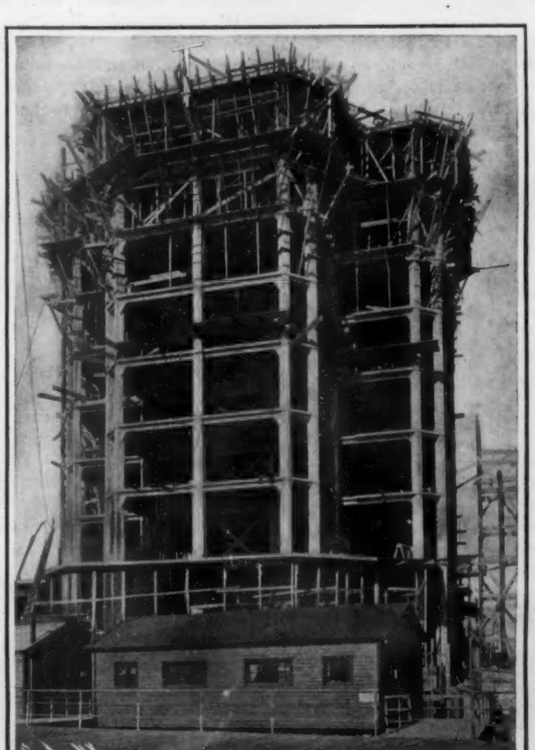
BY DAY ALLEN WILLEY.

An interesting example of the use of concrete in building construction is given in several of the newer hotels in Atlantic City, N. J. This resort is on a flat, sandy island separated from the mainland by a marsh. The highest point is but a few feet above high tide and hard formation is at such a depth that most of the structures are supported on elaborate artificial foundations.

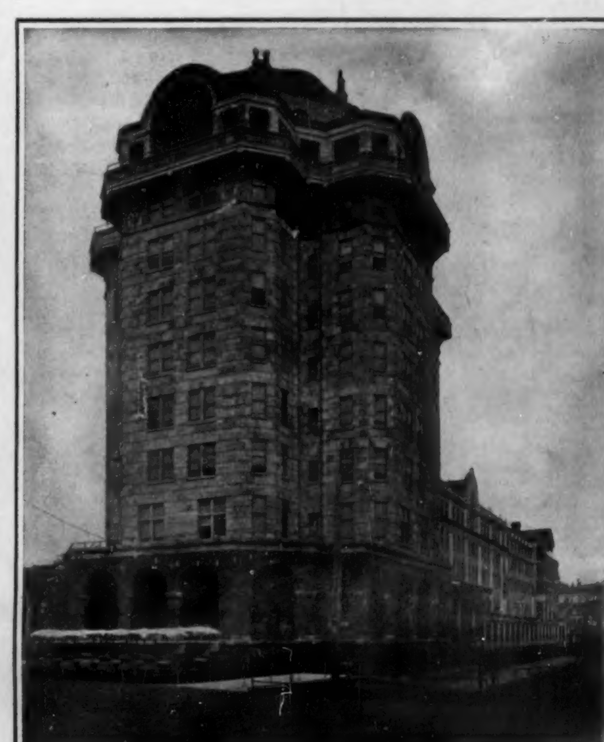
Trussed steel concrete has been successfully employed, and it is the method chosen in the erection of the Traymore which is illustrated here. Considering its dimensions, the building was erected in remarkably short time, the exterior being completed in three months and five days. It has a frontage of 76 feet, a depth of 122 feet, and is nine stories in height, not including the massive dome, which contains three stories.



The First Stages of Erection; the Molds in Position. This Picture Was Taken on October 2, 1906.



The Framework on November 16, 1906; the Molds Not Yet Removed on the Upper Stories.



The Structure Was Finished in Three Months and Five Days.

A REINFORCED CONCRETE HOTEL.

In preparing the foundation, piles were driven to a point below low-water level, and their tops were bedded in the footings of the concrete piers. The piers were built in sheeted pits kept dry by pumping until the first layer of concrete, inclosing the pile tops, had set. On this layer were placed two crossed tiers of Kahn reinforcement bars, above which the offset pier was built in the usual manner with monolithic concrete deposited in wooden forms. In the formation of the various supporting columns, the octagonal as well as the square shape is employed, the smallest dimensions being 10 by 10 inches in the upper story. In the basement the interior columns are 24 inches square, or are octagonal with minimum diameters of 28 inches. Both types are reinforced with eight vertical rods ⅝ inch in diameter located in the middle of the octagonal sides or in the middles and at the angles of the square columns. In the latter the reinforcement rods are connected by 1½ x 3-inch horizontal ties, 10 inches apart vertically. In the octagonal columns the reinforcement bars are connected by a spiral wrapping of ¼-inch wire rod with a pitch of 3 inches, which makes a complete turn around every bar at every intersection. The wall columns are virtually rectangular piers, and, like the interior columns, their dimensions increase from the top downward until in the basement

a maximum of 26 by 26 inches is attained. Beams and girders are made in the standard manner, reinforced with Kahn tension rods in the lower sides which project nearly through the supporting columns. Additional bars about six feet long, reversed so that their prongs point downward, extend through the columns, projecting equally on both sides, and are built into the upper portions of the beams and girders, thus bonding them and providing for cantilever strains at these supports. A framework of this size was considered necessary partly because of the wind pressure, the hotel being on the beach front. The building is proportioned for a wind pressure of 30 pounds per square foot of external vertical surface, and for live loads of 70 pounds per square foot on the "exchange" and eighth floors; all other floors are proportioned for 50 pounds per square foot. The concrete is proportioned for a working load of 500 pounds per square inch in compression, and the reinforcement bars are designed to take all tensile and shearing stress and have a maximum working load of 16,000 pounds per square inch.

The structure was molded, all of the framework being formed in boxes. Carpenters formed about one-half of the building force, since so many molds were required to sustain the great weight of the material. Boxes for the rectangular columns were made of planking 1¼ inches thick carefully fitted together and further secured by battens and set in place by hand. In arranging the system of molds the upper ends of the columns were notched to receive the boxes for the floor beams and girders, which were fitted into them, supported on the ends of the vertical boards and on transverse cleats nailed to both members. The ends of the girder boxes were thus set flush with the inner surfaces of the column boxes and, the joints being thoroughly nailed, were considered by the contractors tighter and more satisfactory than if made in any other manner. The girder boxes were simple rectangular troughs, made like the column boxes, and were supported at intervals between columns on vertical shores with their ends double knee-braced to transverse cleats on the bottoms of the boxes.

The reinforcement bars for the columns were wired together in the iron yard to make rigid frames with the bars in accurate relative positions and were deposited as units in the column boxes and were carefully wired into position. Concrete was wheeled on runways laid on the girder boxes and was dumped from the wheelbarows into the boxes. Special care was taken to compact it and work it well around the reinforcement bars and eliminate all chance of empty space by constant tamping. In the column boxes long-handled spades or simple straight poles were used to work between the reinforcement bars.

In the girder boxes a thin layer of concrete was first spread on the bottom, and then the reinforcement bars were placed accurately on it and moved back and forth until thoroughly set in position, when the remainder of the concrete was filled in and carefully spaded around them. The concrete was leveled off with a straight-edge 2 inches above the tops of the tiles, making the floor slabs, the beams, girders, and columns monolithic and providing a continuous horizontal surface over the full area of the building, from out to out of walls, about 2 inches below the top of the finished floor. After the concrete had set at least ten days, the boxes were stripped from the columns and girders, the timber was roughly cleaned and made up again for use in an upper story. The inner faces of the boxes were scraped clean, but not oiled or coated.

By this method but a small number of mechanical appliances were required. The concrete was composed of Portland cement and traprock of ¾-inch size. It was mixed in portable concrete mixers and that used in the foundation and lower stories delivered to wheelbarrows to be trundled to the work. That for the remainder of the building was delivered from the mixer through a movable chute to a Ransome hoisting bucket. This chute was seated on an inclined bed to which it was connected by a lever that could be operated to set the lower end of the chute over the concrete bucket or to slide it back and up so that the lower end cleared the bucket, and the latter could be hoisted or lowered past it. The concrete mixer and tower were placed in the most central position available so as to minimize the wheeling distance. Adjacent to it there was a hod elevator on which tiles and other material were carried. The hoist delivered the concrete to an elevated platform or chute, closed with a gate at the lower end, which was raised to discharge the concrete into the wheelbarrows below.

After the foundation was completed and ready for the walls, the process of construction was carried on both day and night in order to complete the building as soon as possible. Each gang of workmen comprised about eighty men, and the average rate of progress up to the sixth story was one entire story in six working days.

An advantage of this concrete system is that it is attended with but little sound—a consideration at a fashionable holiday place with other hotels in the vicinity.

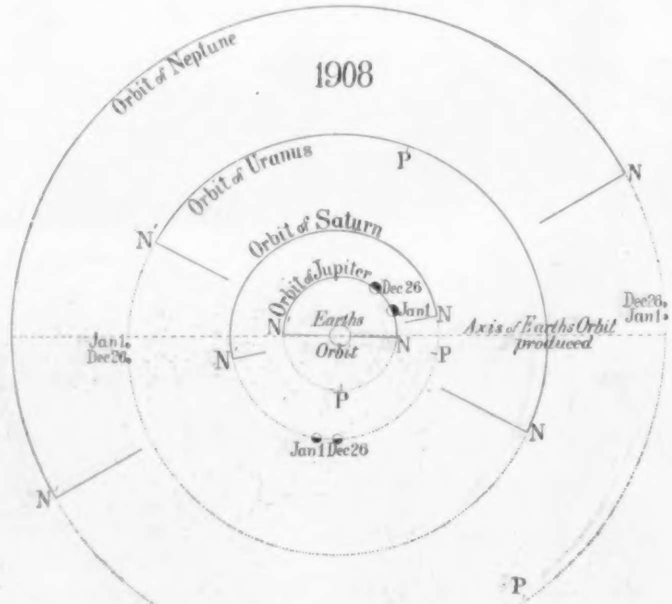
MORNING AND EVENING STARS FOR 1908.

BY FREDERIC R. HONEY, TRINITY COLLEGE.

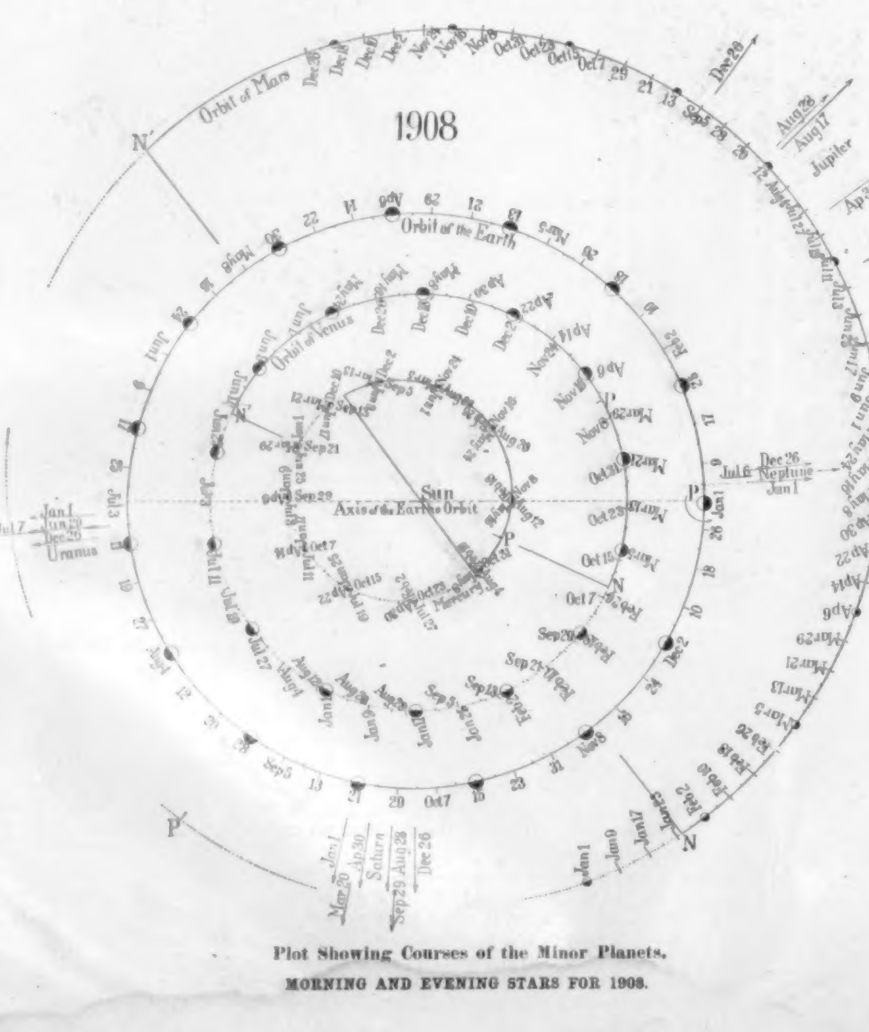
The accompanying plots have been prepared in continuation of those which were printed in the SCIENTIFIC AMERICAN for March 17, 1906, and February 9, 1907. Together they exhibit the changing positions of the planets for three consecutive years. During this period Jupiter makes one-fourth of a revolution; Saturn, one-tenth; Uranus, about one-twenty-ninth; and Neptune, one-fifty-fourth. The orbits are projected on the plane of the ecliptic, i.e., the plane of the earth's orbit. Since the angles formed by the planes of the orbits are small, the slight deviations from their true forms are scarcely noticeable in a plot of these dimensions. The diameter of Neptune's orbit is thirty times that of the earth. It is therefore impossible to plot the orbits of all the planets satisfactorily, on the same scale within the limits of this page. The axis of the earth's orbit is shown in both plots, in order to exhibit the continuity of the solar system, and also to show at a glance the relative positions of the sun and all the planets throughout the year 1908.

If this page is placed in a horizontal position, that part of the planet's orbit which is represented by the full line may be considered as *above*, and that part shown by the dotted line as *below* the plane of the ecliptic. The line joining the points where the planet passes from the space below to that above (the ascending node) with the point where it passes from the space above to that below (the descending node) is the intersection of the plane of the planet's orbit with that of the ecliptic. This is shown in the plot of Mercury's orbit, which to avoid confusion is only partly represented in those of the other planets. In the plot of each orbit, the ascending node is marked *N*, and the descending node *N'*; and the planets' perihelion *P*. The positions of Mercury, Venus, the earth, and Mars at Greenwich noon are shown at intervals of four days.

To become familiar with the use of the plot, this page should be turned around into a position where the earth at any assigned date is between the reader and the sun. This gives an exhibit of the positions of all the planets on this particular day; and this date attached to each planet may be read without turning the head. For example: To obtain this exhibit on January 1, this page should be turned a quarter of the way around. Since the earth rotates in the direction of the arrow, the position of Mercury indicates that the



Positions of the Major Planets for 1908.



Plot Showing Courses of the Minor Planets.

MORNING AND EVENING STARS FOR 1908.

planet rises a short time before the sun, and is morning star. On the same day, Venus, Mars, and Saturn set after the sun, and are evening stars. The positions of each planet relative to the earth and sun throughout the year may be traced. On January 1 Mercury is below the plane of the ecliptic. On January 14, when the planet reaches superior conjunction, it is in line with the earth and sun. After this date it sets after the sun, and is evening star. On February 9 Mercury is at the ascending node; and on February 28 he comes between the earth and the sun, and reaches inferior conjunction. After this date the planet is morning star, and is at the descending node on March 18. Mercury is again in line with the earth and sun at superior conjunction on May 7, and becomes evening star. Since his period of revolution is eighty-eight days, Mercury makes a little over four revolutions during the year. The planet's center is shown in twenty-two positions. The dates are attached at intervals of eight days for three hundred and fifty-two days. Intermediate dates are easily supplied. They are omitted in the drawing in order to avoid confusion. With the assistance of a straightedge, the dates of inferior and superior conjunctions may be determined for the rest of the year. After inferior conjunctions, Mercury becomes morning star; and after superior conjunctions, evening star.

At the beginning of the year, Venus is below the plane of the ecliptic. The planet is at the ascending node on February 27; at the descending node, June 18; and reaches inferior conjunction July 5. Prior to this date Venus sets after the sun, and is evening star. After July 5 she rises before the sun, and is morning star for the rest of the year, reaching the ascending node October 9. Venus completes a revolution in 224.7 days. On August 12 the planet comes to a position that very nearly coincides with that of January 1. The space between the two positions is the distance traversed in 0.7 of a day. The new date attached for the rest of the year belongs in each case to the point on the orbit which is a little behind that of the first revolution.

On January 1 Mars is below the plane of the ecliptic; on the 27th he is at the ascending node, and remains above the plane of the ecliptic until the end of the year. The planet is in conjunction with the sun August 21. After this date it is morning star for the rest of the year.

Jupiter is at opposition on January 29, and in conjunction with the sun August 17. Before conjunction, the planet is evening star; after conjunction, it becomes morning star. Jupiter is above the plane of the ecliptic throughout the year.

Saturn is below the plane of the ecliptic the entire year. The planet is evening star until conjunction with the sun March 20, when it becomes morning star. Saturn is at opposition on September 29.

Uranus is morning star after January 4, when the planet is in conjunction with the sun. Opposition occurs July 7.

Neptune is at opposition on January 4; and in conjunction with the sun, July 6. Before conjunction, the planet is evening star; after conjunction, it becomes morning star.

It should be noted that the precise position of a planet at the time of the conjunction or opposition is generally somewhere between the positions which are marked on the orbit at the beginning and end of the astronomical day.

Neptune comes to opposition on January 4. Since the planet moves very slowly, its position in the plot is practically the same as that of January 1. Opposition occurs between the positions of the earth marked 4th and 5th, and is near the end of the day, as shown in the drawing.

Uranus comes to opposition at the end of the day, July 6. The position of the planet is given for July 7.

A Novel Experiment Showing Sound Transmission by the Aid of Electric Waves.

Whereas in the Poulsen method of wireless telephony the electric waves are generated by an electric arc, thus requiring a generator of high-tension current, the transmission of single sounds, as shown by Mr. P. Spies before the recent Congress of German Naturalists and Physicists, can be effected with exceedingly simple means.

By interrupting the current of a coil of wire in the rhythm of the vibrations of a chord or a whistle tongue, the electromotive force or self-induction can in fact be made to set up vibrations in an antenna with counterpoise, connected in parallel with the interrupter spark. These vibrations, as demonstrated by the author, will actuate at the receiving station a convenient detector, reproducing the sound of the interrupter in a telephone receiver.

This process is analogous to the Poulsen experiment in so far as each sound vibration consists in both cases of a large number of electric waves, the frequency of which is far beyond the limits of audibility.

This process will possibly be used for giving Morse signals, although all attempts to utilize it for the purposes of wireless telephony have so far failed. As it is, the simple apparatus exhibited by Mr. Spies will prove very valuable for demonstration purposes.

Aeronautical Notes.

On February 1, the date of closing of the bids for the aeroplane or other heavier-than-air flying machines for our army, no less than forty-one bids were received. This number was much greater than had been expected. The bids were to be opened on February 4 by the Board of Ordnance and Fortifications, but it was subsequently decided to turn them over for the consideration of the Secretary of War, and until the Secretary has seen them, none of the proposals will be made public. It is gratifying to note that even with the extremely rigorous conditions prevailing, more than two-score bids were made. The probabilities are that out of this number, there will be two or three machines at least which will be found worthy of serious consideration.

The Junior Aero Club of the United States is the latest organization for the study of aeronautics in this country. The new club has an advisory board consisting of five members of the Aero Club of America. Not only will experiments in aeronautics be tried, but experiments will be conducted in wireless telegraphy, telephony, etc., as applied to the new science. It is planned to hold a competition of small "pilot" balloons, starting from New York city or some nearby point on May 30. Prizes will be offered for the balloon making the greatest distance, the one having the most ingenious arrangement for the disposal of ballast during the flight, etc. It is planned to obtain the assistance of the Weather Bureau in conducting this contest. The material for constructing the balloons will be furnished for a small amount from the headquarters of the club, which are located at 131 West 23d Street, New York. There are three classes of members: (1) Honorary; (2) active members who construct their own apparatus; (3) active members who own apparatus not constructed by themselves. No person over twenty-one years of age is eligible. Annual dues of twenty-five cents must be forwarded with the letter of application. If sufficient interest is shown, arrangements will be made for lectures and debates by members of the New York city club, as well as at the branches of ten members or more, which it is proposed to form. The new club has been organized by Miss E. L. Todd, who will be the secretary. In applying for membership, the applicant must fill out a blank giving his or her name, age, residence, and the nature of the exhibit which the applicant proposes to make, i.e., whether it is for the contest or for exhibition, and whether it is made or purchased by the applicant.

At the 1908 Munich exposition there will be a prize competition for model aeroplanes. This competition will be conducted by the Sports Committee with the aid of the Munich Aerial Navigation Club. Models with or without motors may be entered, but only those of the latter type are eligible for the contest. These model gliding machines must have a supporting surface of not less than 1 square meter (10.76 square feet) or more than 2 square meters (21.528 square feet). Their total weight must be at least ½ kilogramme per square meter (1.6 ounces per square foot). There is no great restriction on the motor-driven model. The competition of the gliding models will take place in a suitable hall some time during the exposition. No model will be eligible for a prize which does not cover a distance of at least 15 meters (49.2 feet) measured horizontally from the starting place. The aeroplanes will be started from a height of 2 meters (6½ feet) and two tests will be allowed. Applications should be made by March 1 to the Sports Committee, Neuhauserstrasse 10, Munich, Bavaria.

The Board of Regents for the Jubilee Endowment of German Industries has made an annual appropriation of 25,000 marks ($5,965) for aeronautic research. The money will be expended to aid inventors in experiments with dirigible balloons, aeroplanes, and other heavier-than-air flying machines.

The Belgian Committee of Aviation has organized a competition of aeroplanes for three dates in July, the 9th, the 16th, and the 23d. The Sauveniere race course at Spa, which is 2,300 meters (7,546 feet) in circumference, will be utilized for these contests. On the first two dates a circular kilometer and a kilometer in the form of the figure 8 will be the flights required, while on the last date it is proposed to hold a long-distance race, consisting of ten circuits of the course, or about 23 kilometers (14.3 miles). A sum of 75,000 francs ($14,475) will be offered as prizes for the various flights. Among the entries already received are those of Farman, Pelterie, Bleriot, Delagrange, Voisin, and Capt. Ferber. M. Miesse, a Belgian experimenter, is also expected to compete.

Now that the Deutsch-Archdeacon $10,000 prize for a flight of a kilometer in a closed circuit has been won, M. Archdeacon believes that the surest way of stimulating progress is the offering of another large prize of at least double this amount for a long-distance flight of about 25 kilometers (15½ miles). He made the suggestion to Chevalier Vincenzo Florio, the Italian nobleman who has wagered with his countryman Vonwiller that he will fly around the racetrack at Palermo before the end of the year with an aeroplane, that the winner should donate the money and make of it an aeronautic prize. Chevalier Florio points out that at the present time a flight of 25 kilometers is far in advance of what has actually been accomplished, and that, therefore, there would be little advantage in the winner, if there is one, doing what Archdeacon suggests. On the other hand, he makes the significant statement that when there is a reasonable prospect of ten competitors flying a race of this distance, it will be decidedly to their advantage to make the attempt at Palermo.

Apropos of the various prizes which have been offered in England for aeroplane flights, it is interesting to note the expression of opinion of Mr. Henry Farman after making a trip to England to investigate these prizes and to find a suitable place at which to compete for them. The prize of £1,000 ($4,860) offered by the Daily Graphic for a flight over a mile in length above the Brooklands automobile racetrack at any time prior to the first of August, Farman believes to be impossible of winning, as the track is not a suitable place for such a flight, on account of the bridges which span it and the telegraph wires which are strung all around. The only place which is suitable is a smooth turfed field about a half mile square. This field must be entirely free from ditches and other obstructions, and the surface must be smooth enough to ride a bicycle upon at a good pace, as otherwise, if the ground were rough, the machine would be in danger of being broken. Furthermore, it is quite impossible to fix in advance the day and hour at which the flight can be made, as this depends entirely upon the weather. In the case of the Deutsch-Archdeacon prize, the competitor had to give twenty-four hours' notice. The prizes which are offered in England, however, are speculative in character, the idea being to charge spectators an entrance fee, and in this manner to make up the prize. Mr. Farman states that he is experimenting for his own amusement, and that he does not intend to try for any more prizes save those which have no difficult restrictions. His new aeroplane, which was described in our last issue, will soon be ready. In the meantime he has had his first one covered with a new waterproof material, which is lighter and stronger than the canvas formerly used. During his sojourn in England, Farman gave some interesting information regarding the difficulty of controlling his machine when in the air. He stated that the aeroplane not only had a tendency to describe a sinuous course in a horizontal plane, but in a perpendicular plane as well, and that it was necessary to constantly maneuver the horizonal rudder, in order to keep the machine from plunging to the ground or from diving upward and turning a backward somersault. If the ground is not quite level, there is danger of the machine striking any slight elevation when making one of its downward plunges, and this might result in an accident. This seems to show that even with its steadying tail, the machine is by no means stable in a fore-and-aft direction. The smaller vertical rudder which is located in the center of the tail, and which is about half the width of the latter in a fore-and-aft direction, i. e., about 3 feet, does not seem sufficient to keep the aeroplane from veering to the right or left. In the description published in our last issue, it was erroneously stated that the vertical end pieces of the steadying tail acted as rudders. That the transverse stability, also, is none too good, may be ascertained from a statement of an eyewitness that even when flying in a straight line, the aeroplane is liable to tip to one side or the other at a considerable angle, as noticed in the photograph reproduced in our last issue showing the machine turning in a circle.

Official Meteorological Summary, New York, N. Y., January, 1908.

Atmospheric pressure: Highest, 30.60; lowest, 28.89; mean, 29.99. Temperature: Highest, 53; date, 21st; lowest, 4; date, 31st; mean of warmest day, 46; date, 21st; coolest day, 10; date, 30th; mean of maximum for the month, 38.9; mean of minimum, 25.1; absolute mean, 32; normal, 30.5; excess compared with the mean of 38 years, +1.5. Warmest mean temperature of January, 40, in 1880, 1890. Coldest mean, 23, in 1893. Absolute maximum and minimum for this month for 38 years, 67 and —6. Precipitation: 3.84; greatest in 24 hours, 1.31; date, 12th; average of this month for 38 years, 3.77. Excess, +0.07. Greatest January precipitation, 6.15, in 1882; least, 1.15, in 1871. Wind: Prevailing direction, northwest; total movement, 11.033 miles; average hourly velocity, 14.8 miles; maximum velocity, 48 miles per hour. Weather: Clear days, 9; partly cloudy, 14; cloudy, 8; on which 0.01 inch, or more, of precipitation occurred, 9. Hail, 12th; fog (dense), 12th. Snowfall, 10.6.

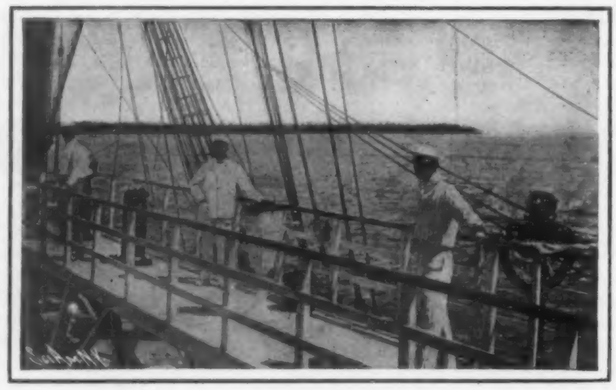
MAGNETIC SURVEY ON THE PACIFIC OCEAN.

BY HERBERT T. WADE.

One of the most important of modern scientific undertakings is the general magnetic survey of the globe now being executed by the Department of Research in Terrestrial Magnetism of the Carnegie Institution of Washington, under the direction of Dr. L. A. Bauer, formerly in charge of the magnetic survey of the United States under the United States Coast and Geodetic Survey. One phase of this work in which considerable interest is being manifested is the magnetic survey of the Pacific Ocean which has been conducted by observers in the sailing ship "Galilee" during the past three years. The practical value of magnetic work is appreciated instantly when one realizes that the underlying basis of surveying and navigation is the compass. As is well known, the magnetic needle does not point to the true or geographical North Pole except at a comparatively small number of points located on what are termed agonic lines. Nor are the indications of the needle for a given place constant with time, and as an example can be cited a survey originally made at Baltimore, Md., in 1800, where the compass directions for the same bearings, if measured to-day, would vary about five degrees from those of a century ago. In the eastern part of the United States there is a tendency at present for the magnetic needle to move westerly at an average yearly rate of from 3 to 3½ minutes. It is, of course, important not only to study these changes of declination or variation of the magnetic from the geographical meridian, in their various aspects at as many points as possible, but also the inclination from the horizontal of a freely swinging magnet, known as its dip, and the magnetic intensity or strength of the earth's magnetism. To that end there are maintained many government and other magnetic observatories and surveys, so that in the United States there are about 3,500 well distributed points where the above elements have been accurately determined.

As the surface of the earth includes nearly three times as much water as land, it is most essential to know the magnetic conditions of various points on the oceans in order to supply to the navigator as precise and comprehensive information as possible, as well as to afford the magnetician an adequate idea of the distribution of magnetism over the earth. This knowledge of the magnetic elements is most necessary in deep-sea sailing, since the navigator is forced to correct his compass bearings as indicated by the magnetic needle by adding or subtracting the proper magnetic variation or declination given on his chart. Now suppose the voyage is made in stormy or cloudy weather, where for days it is impossible to determine the position of the vessel by the usual sextant observations of the sun or other celestial bodies, then the navigation must be by dead-reckoning, ascertaining the position from the distances as given by the log and the direction from the compass. But before the compass courses are laid off on the chart they must be corrected by adding or subtracting the variation scaled from the chart.

For the Pacific Ocean, despite its increasing commercial importance, comparatively little had been done prior to the Carnegie Institution work to improve and extend the magnetic information given on the charts. Indeed, the past magnetic charts were based largely on observations made on such exploring expeditions as those of the British ships "Erebus," "Terror," and "Pagoda" (1840-45), the Austrian frigate "Novara" (1857-60), the famous deep-sea exploring vessel "Challenger" (1872-76), the German vessel "Gazelle" (1874-76), and other more or less extended surveys made by warships or other vessels engaged in hydrographic work. Mention might be made of the valuable magnetic work done by recent Antarctic expeditions in addition to those mentioned, but in the main the more recent magnetic data for Pacific charts have been obtained from observations made either on islands or the coasts of the continents, and the continued use of the earlier material. As a result there were important errors in the magnetic values taken from the various government charts, even on such well-traversed routes as between San Francisco and Honolulu, where both the British and the German Admiralty charts were in error by from 1 deg. to 2 deg., giving too small a value for the easterly declination. Now, this distance is about 2,000 miles, and if a systematic error of 1 deg. persisted on a voyage where clouds or fog prevented observation of the sun or stars, a ship navigated by compass and log at the end of its journey would be too far north by about 35 miles or one-sixtieth of the distance traveled, an error whose possible serious consequences it is not difficult to imagine. In other regions of the Pacific Ocean the errors in some of the previous magnetic charts amounted at times to from 3 deg. to 5 deg.



Kelvin compass. Horizontal force instrument. Ritchie compass. Dip circle and total force instrument.

Scientific Personnel.

J. P. Ault, Magnetic Observer. H. E. Martyn, Surgeon and Recorder. J. C. Peters, Commander.

Observing Bridge of the "Galilee" and Instruments.

Taken by J. C. Pearson, Magnetic Observer.

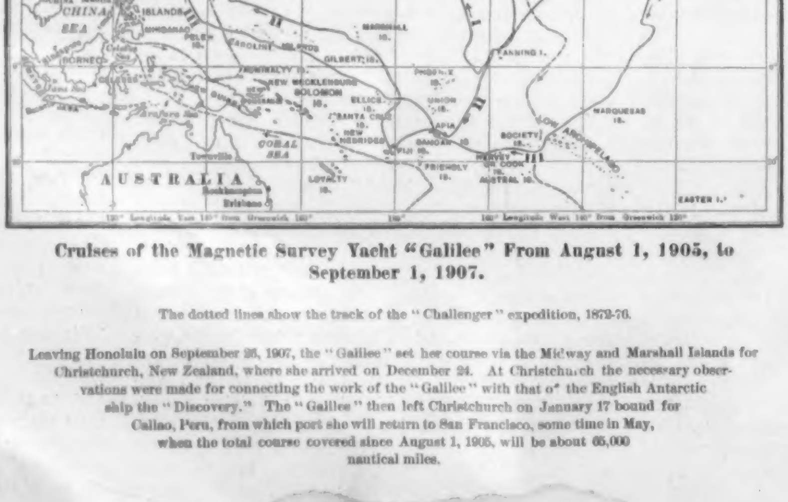
So when the Carnegie Institution determined early in its magnetic work to make a thorough survey of the Pacific Ocean, the proposition was well received not only by students of terrestrial magnetism, but by hydrographers and navigators. Accordingly, in 1905 the wooden sailing vessel "Galilee" was chartered at San Francisco and the first cruise was begun in August of that year. The "Galilee" is a wooden brig, built in 1891, and is 132.4 feet in length, 33.4 feet in beam, 12.6 feet in depth, and of about 600 tons displacement. The steel rigging was replaced by hemp, and as much as possible of the iron and steel in the blocks, tackle, and other fittings was changed to non-magnetic metal, so that while the entire elimination of iron and steel was impossible it was reduced to a minimum, and the vessel in this respect was far superior to any ship previously employed in magnetic work. Nevertheless deviation corrections incident to the presence of a small amount of iron have to be considered and applied to the observations.

The only striking feature of the ship is the fore-and-aft bridge 15 feet above the deck extending from the foremast to the mainmast, on which are mounted the compasses and other instruments. Three of the fixed instruments are essentially marine compasses of well-known types, but the dip circle is provided with a special mounting, as is shown in more detail in a separate illustration. The declination can be measured with any of the compasses provided with an azimuth circle, which is a device fitted on top of the compass and provided with sights for observing the bearing of the sun or other celestial body. Knowing thus the angle which the direction of the sun makes with the magnetic meridian as indicated by the compass, the exact time of observation from the ship's chronometer, the sun's declination from the Nautical Almanac, and the latitude and longitude of the place of observation, the true north and south meridian can be found and the variation of the compass for that time and place determined. In making observations of the celestial bodies, clear weather is all-essential, and this has been the greatest difficulty so far experienced in the magnetic work on the Pacific.

For declination, as well as for dip and intensity, two simultaneous observations are usually made at different parts of the bridge, and the motion of the ship does not interfere with the observations as much as the meteorological conditions. The method of making the most accurate observations is to "swing ship," that is, cause it to point in different directions as respects the magnetic meridian, and then to attempt readings at eight equidistant points. In a harbor where there is a tug available this is comparatively simple, and also in calm weather at sea, as the "Galilee" now carries a naphtha launch to assist in this maneuver, but in heavy weather or when a sea is running it is often quite difficult, if not impossible, and the observers must be satisfied with fewer observations. From the "swings," the necessary corrections are likewise determined, due to the effect of the remaining iron on board, consisting chiefly of the iron bolts in the sides of the vessel. The endeavor is to make a "swing" about every third or fourth day; it then suffices to make the observations on the intervening days on the ship's course. In port it is customary to make still more elaborate observations and also measurements on shore, and where possible to compare results and standardize the instruments with those of some magnetic observatory.

Next to the compass with its azimuth circle, the most important instrument is the dip circle for determining the dip or inclination and also the total intensity. The Lloyd-Creak pattern, which is employed, consists essentially of a magnetic needle free to revolve about a horizontal axis and mounted on jeweled bearings. When freely swinging in the vertical plane of the magnetic meridian the needle will indicate the inclination for that particular point. The angle is read with microscopes on a divided circle and the magnetic needles can be reversed or different needles can be used. The total magnetic intensity can be deduced from observations made with the dip circle, while for horizontal intensity, or that part of the magnetic force that is exerted on a properly balanced compass needle, there is used a special apparatus differing from that usually employed on land where the magnet is placed in the same horizontal plane as the compass needle. On the "Galilee" the deflecting magnet is placed above the compass on a small brass bridge or frame as shown in the illustration of the Ritchie-Negus compass with the binnacle case removed. Now, the magnet used to deflect the compass needle has been studied carefully and its magnetic moment and other constants have been determined, so that noting the deflections it is possible to compute the horizontal intensity at any given place. The value of the horizontal intensity determined directly with this apparatus furnishes a check upon that deduced from the dip and total intensity measurements with the Lloyd-Creak dip circle.

As soon as the observations are



Cruises of the Magnetic Survey Yacht "Galilee" From August 1, 1905, to September 1, 1907.

The dotted lines show the track of the "Challenger" expedition, 1872-76.

Leaving Honolulu on September 26, 1907, the "Galilee" set her course via the Midway and Marshall Islands for Christchurch, New Zealand, where she arrived on December 24. At Christchurch the necessary observations were made for connecting the work of the "Galilee" with that of the English Antarctic ship the "Discovery." The "Galilee" then left Christchurch on January 17 bound for Callao, Peru, from which port she will return to San Francisco, some time in May, when the total course covered since August 1, 1905, will be about 65,000 nautical miles.

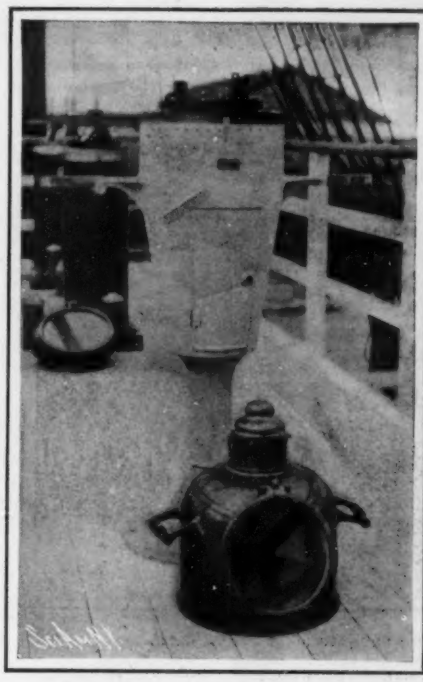
MAGNETIC SURVEY ON THE PACIFIC OCEAN.

made they are reduced and tabulated to be mailed to Washington from the next port, and the office staff there proceeds immediately with their computation and discussion. The preliminary results as fast as they are available are placed at the disposal of institutions and individuals interested, and the first practical outcome of the Pacific work was the publication in May of last year by the United States Hydrographic Office of a new chart of the lines of equal variation for 1910 in which use was made of the data from the "Galilee's" survey. The Hydrographic Office also has in preparation charts showing lines of equal magnetic dip and lines of equal magnetic intensity which, because of this new material, will be far more accurate than those now in use.

The three cruises of the "Galilee" will amount in length to about 65,000 nautical miles by next May, when the vessel returns to San Francisco from South America. The courses traversed are shown on the accompanying map, and on these observations were made on an average about every 200 or 250 miles. For future work the Carnegie Institution has under consideration the design and construction of a vessel especially adapted for magnetic work, with auxiliary motive power in the form of a gasoline engine. This would enable the survey to be carried on much more efficiently, as with a non-magnetic vessel the necessity for swinging ship is not so apparent. The special construction of the hull for magnetic work would diminish the labor of observation and office reduction by bringing the deviation down to an inappreciable quantity.

The great value of the magnetic work in the Pacific Ocean by the Carnegie Institution has been demonstrated, and it must be remembered that this is only one branch of the work of the Department of Terrestrial Magnetism, which is devoting itself quite as actively to theoretical studies and investigations in inaccessible and unexplored places. The results so far attained from the annual appropriations ($57,000 in 1907) show the wisdom of the Carnegie Institution in supporting adequately some particular branch of science instead of awarding small grants to a number of unorganized workers engaged in different fields of activity.

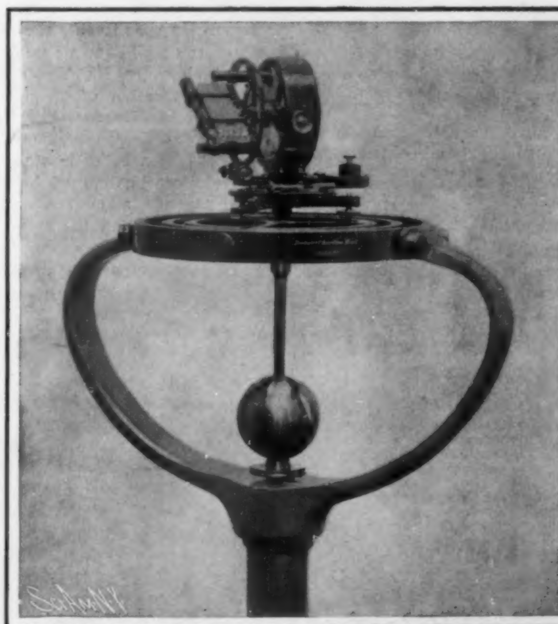
An improved "pedestrian catcher," to prevent accident to persons run down by tramcars, is attracting attention in Dresden. It is easily attached to cars, does not get out of order, and picks up and carries along life-size leathern manikins, living dogs, and even bottles filled with liquid.

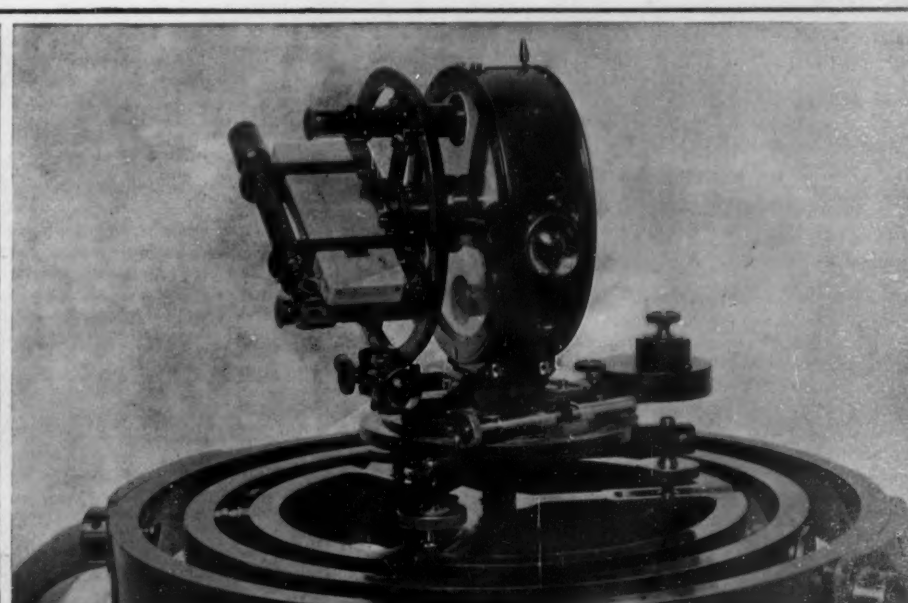


Ritchie United States Navy Standard Compass and Azimuth Circle for Determining the Magnetic Declination (Variation of the Compass).

Horizontal Force Instrument Devised by the Department of Terrestrial Magnetism.

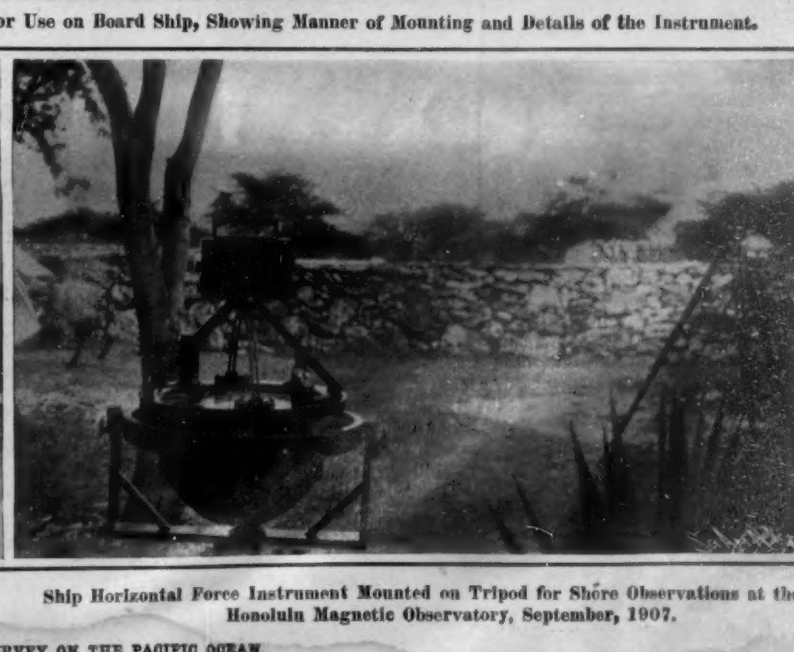
L. A. Bauer, director, making trial observations on the cruise from San Francisco to San Diego.





Dip Circle and Total Force Instrument Mounted on Gimbal Stand for Use on Board Ship, Showing Manner of Mounting and Details of the Instrument.

The "Galilee" at Anchor in Sitka Harbor, July, 1907.



Ship Horizontal Force Instrument Mounted on Tripod for Shore Observations at the Honolulu Magnetic Observatory, September, 1907.

MAGNETIC SURVEY ON THE PACIFIC OCEAN.

THE SAMPSON GAS-ELECTRIC ROAD TRAIN.

The greatest novelty exhibited at the last Automobile Show held two months ago in Madison Square Garden was a hauling train for transporting freight across country over all kinds and conditions of roads. This train, which is the invention of Mr. Alden Sampson, of Pittsfield, Mass., consists of a motor truck and two trailers. It was somewhat similar to the European road train of Col. Renard (which was illustrated some time ago in the SUPPLEMENT); but there are many points in which it is a decided improvement over its predecessor. The chief of these is the power adopted for propulsion, which in this case is electricity generated by a dynamo connected to a four-cylinder gasoline motor and located on the head machine. Another feature is the use of six-wheeled trucks having two large driving wheels in the center and the four remaining smaller wheels of which are all pivoted for steering.

The power plant used is illustrated in one of the photographs reproduced herewith. The engine is a powerful 4-cylinder motor capable of developing 40 horse-power, and it drives the dynamo, as shown, through a Morse silent chain. The voltage can be varied, in order that the engine will not be overloaded when all the motors are drawing their maximum current. The series-parallel control system is used, the controller being interlocked with the starting rheostat. By means of switches and extra cables, any trailer can be made to move by itself forward or backward while the other trailers are disconnected.

As can be seen from the photograph of the train making the sharp turn, both the front and the rear pairs of wheels of each machine turn when the vehicle is rounding a corner. This arrangement makes it possible to turn in a very short radius. The steering lever arms of the front and the rear pairs of wheels are connected together by universally-jointed connecting rods running across diagonally beneath each vehicle. On account of this double steering arrangement, it is possible to turn the whole train, which is 60 feet in length, in a circle having a radius of about 20 feet.

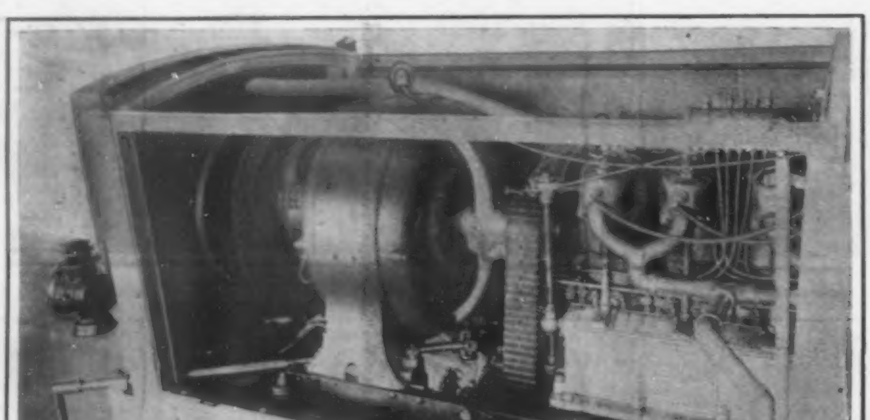
The different cars of the train are connected together by drawbars, but these are used simply for preserving the distance between the cars and also to equalize traction, as each car is self-propelled by a pair of electric motors, each one of which is connected by spur gears to a short countershaft carrying a sprocket, from which a chain extends to a large sprocket upon the 54-inch driving wheel on that side of the car. This arrangement of an independent electric motor for each driving wheel does away with differential gears, while the simple chain drive makes it possible to dispense with the universally-jointed driving shafts and the bevel driving gears needed on the more complicated Renard train, in which the power is transmitted mechanically from the head car to the trailers.

The first experimental train, shown in the photograph, has hauled a load of 20 tons at a speed of 6 miles an hour on level macadam roads, and has ascended a 10 per cent grade at the rate of 2 miles an hour. On level dirt roads the train will travel at about 5 miles an hour. The tractor has a capacity of 2 or 3 tons dead weight, and each trailer will carry 6 to 8 tons. As each machine is entirely self-propelled without the transmission of power mechanically from the tractor, and also on account of the design of these machines with six wheels each, the train can travel up and down hill over comparatively rough roads without difficulty. An electric brake is provided, and each machine also has powerful expanding brakes in hub drums on the driving wheels.

Further particulars of this new train, showing more of the details of its mechanism, will be published in the next issue of the SCIENTIFIC AMERICAN SUPPLEMENT.

The Tractor and Two Trailers Making an Extremely Sharp Turn.

The front and rear pairs of wheels of the tractor are shown turned in opposite directions.



The Power Plant on the Tractor.

A dynamo in front is chain-driven from a 40-horse-power, 4-cylinder engine.

AN AMERICAN ROAD TRAIN FOR HAULING HEAVY LOADS.

First Award of the Perkin Medal.

The Perkin medal, founded in honor of Sir William Perkin, and to be awarded annually "to that chemist residing in the United States who had accomplished the most valuable work in applied chemistry during his career, whether this had proved successful at the time of execution or publication, or whether it subsequently became valuable in the development of the industry," has just been awarded to Mr. J. B. F. Herreshoff.

Mr. Herreshoff, who receives the first medal awarded, has for more than thirty years been engaged in inventions and improvements, tending to greatly increased output, together with reduction of working expense, in many lines of chemical industry. Twenty-five years ago he invented his steel-inclosed, water-jacketed copper smelting furnace, superseding the old brick furnaces. His improvements in the electrolytic refining of copper have quite revolutionized the industry. As a result of his efforts, the firm with which he is associated has created the largest copper refinery in the world, a plant with an output of about 1,000,000 pounds of copper daily, or about one-fourth of the world's entire output.

Mr. Herreshoff has numerous "minor" improvements to his record—"minor" only as compared with the more important things he has done. Some ten years ago he patented his roasting furnace for fine iron pyrites ores. Previous to this time pyrites fines were a drug on the market; now more than a million tons of the ore is roasted annually, enough to make about twice that amount of oil of vitriol. Mr. Herreshoff's crowning achievement has been his development of the contact process for the manufacture of sulphuric acid, where he has successfully adapted European discoveries to American conditions. More than twenty years ago, with his device of the Herreshoff tower, and other radical improvements on the current methods of manufacturing sulphuric acid, he modernized the industry; now with his contact method he has again done so. The Society of Chemical Industry is to be congratulated on having the opportunity to so worthily bestow the first Perkin medal.

Commander Robert E. Peary states that he will leave New York on July 1 next on another polar expedition. He will winter at Cape Sheridan, and prepare for a dash to the pole during the summer of 1909. At Cape Sheridan the sun sets on October 12, and does not rise again till the 1st of March.

Tea and Tea Drinking.

Acting upon the suggestion of the Southwark Borough Council, Dr. Tebb, public analyst for the borough, has made an investigation into the nature of the tea commonly drunk in London, and has published his results in an interesting pamphlet on "Tea and the Effects of Tea Drinking." He points out that when tea was first introduced into England it was looked upon as a medicine rather than as a beverage. In 1657 a merchant named T. Garwey published an advertisement sheet extolling the beneficial effects of tea, and inviting purchasers to taste it at his office in the city. The first official notice is found in an act of Charles II., in which a duty of 8d. is imposed upon every gallon of tea sold. During the eighteenth century the drinking of tea gradually became fashionable, but it was not until well into the nineteenth century that its use became general. In the years between 1801 and 1810, the amount of tea annually consumed per head of population was only 1.41 pounds; but by 1901-3 it had risen to 6.10 pounds per head, a quantity much in excess of that consumed in most Continental countries. In some of the British colonies, still greater quantities are drunk, the amounts in different parts of Australia, for instance, ranging from 6.41 to 10.07 pounds per head. This large consumption of tea must unquestionably have its effect upon the health of the nation; and there is medical evidence that many cases of lunacy are to be attributed to excessive tea drinking. The chief active agent in tea is an alkaloid which is believed to be identical with the caffeine in coffee. It is to this alkaloid that tea owes its stimulating action upon the nerves. To the other important constituent, the tannin, are attributed most of the well-known injurious effects of excessive tea drinking. In Dr. Tebb's experiments to determine the proportion of these two substances in the tea as drunk in London, infusions were prepared from 43 representative samples of different origin, eight grammes of tea being treated for five minutes with 600 cubic centimeters of boiling water in each case. The average amount of alkaloid found in the infusions from Indian tea was 2.84 per cent; while Ceylon tea gave 2.64 per cent, and China tea 2.40 per cent. The corresponding amounts of tannin were 7.43, 7.85, and 6.08 per cent respectively. In similar analyses of the teas sold by the four companies supplying most of the restaurants in London, Indian teas yielded infusions containing 2.04 to 3.02 per cent of alakaloid and 6.03 to 9.74 per cent of tannin; China teas, 2.15 to 2.51 per cent of alkaloid and 3.02 to 5.85 per cent of tannin; and Russian tea, 2.30 per cent of alkaloid and 5.36 per cent of tannin. These results bear out the commonly accepted belief that China tea usually contains less tannin than Indian teas, and although this is not invariably the case, it is easily possible with the aid of analysis to obtain supplies of such tea containing a very low proportion of the injurious constituent.—Knowledge and Scientific News.

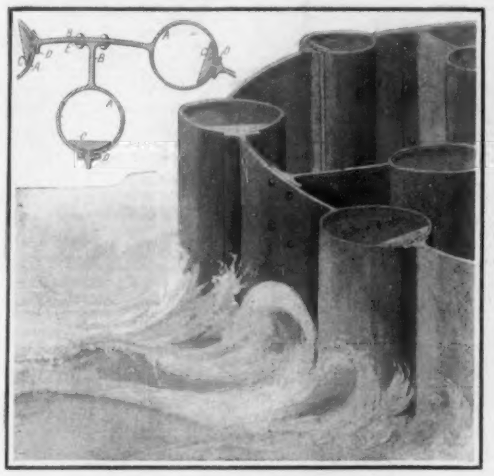
In order to test the effect of vanadium upon steel, a mild steel free from phosphorus, with a tensile strength of 30 tons per square inch and 17 per cent of elongation, was melted in a graphite crucible. It thereupon became carbonized, and showed 61 tons tensile and 23 per cent elongation. On adding 1 per cent of vanadium the tensile strength was raised to 69 tons, with an elastic limit of 50 tons, and 7.3 per cent elongation.

Cracks in Mahogany.—To remove cracks in mahogany the Leipz. D. Drechslerztg. recommends the following process: A concentrated solution of gum Arabic and English red, both thoroughly mixed, is pressed into the cracks with a spatula; a slight addition of dragon's blood dissolved in alcohol imparts to the polish of the mahogany a brilliant, beautiful tone.

Patent Department

A NEW FORM OF SHEET PILING.

Pictured in the accompanying engraving is a new form of sheet piling, adapted to be driven into sand or soft earth, to support the surrounding material while excavations are being made, foundations laid,

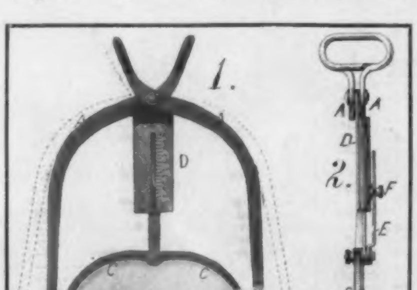


A NEW FORM OF SHEET PILING.

and other similar work carried on. The piling consists of a number of tubular units connected by sheets or webs. The tubular members may be filled with concrete to serve as a permanent foundation for buildings, bridges, and the like. When used in the construction of piers, a large circle or ring of the piling is driven, and the material is excavated from inside the inclosure. Heretofore considerable difficulty has been experienced in effecting a tight joint between adjacent sections, but the piling here illustrated is so constructed that the joints may be made substantially watertight, and, furthermore, the webs may be made to form any suitable shape or size of inclosure. As shown in the cross sectional view, each tubular pile *A* is provided with a slot at one side. Projecting from the opposite side of the pile is a web *B*, which at its outer end is adapted to enter and engage the slot in the next pile. The extremity of the web is formed with a bead *C*, which fits against the inner face of the adjacent pile, while a pair of lateral flanges *D*, fit against the outer face and cover the slot. As it is customary to drive the piling in a circle, the webs are preferably curved. To furnish radial bracing, some of the webs end in a crosshead, as shown at *E*, and may be riveted to the curved webs. As the piles are driven into the sand, the material is removed by means of a jet tube. After the first pile is driven, the slots in the second and succeeding piles will be closed by the webs, so that the sand may easily be removed. A patent on this sheet piling has been secured by Mr. Jesse T. Pyle, of Amarillo, Texas.

ICE TONGS WITH WEIGHING ATTACHMENT.

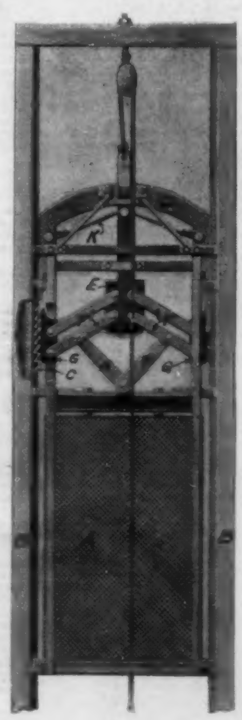
With a view to allaying the suspicions of customers, Mr. W. B. Moore, of Miami, Fla., has invented a weighing attachment for ice tongs, so that the iceman can show that he is delivering full weight. As pictured in the accompanying engraving, a pair of arms *A* are pivoted together like the arms of the ordinary ice tongs. The arms *A* are formed with the usual handles at their upper ends, but at the lower ends they carry guide loops *B*, which embrace a pair of auxiliary arms *C*. The latter are attached to the spring rod of a scale *D*. The case of the scale is attached at its upper end to the pivot pin connecting the arms *A*. The lower ends of the auxiliary arms are formed with spurs adapted to engage the ice. In use the handles of the arms *A* may be operated in the ordinary manner to open or close the tongs; and when lifting the ice by means of the handles, the weight of the block will be indicated on the scale. When it is desired to throw the scale out of use, the rod *E*, which connects with the arms *C*, is clamped to the casing of the scale by means of a thumb nut *F*. As some customers may be suspicious of the connection between the arms *A* and *C*, the loops *B* are formed with a hinged side plate *G*. By turning the thumb nut *H*, the plate *G* may be released and turned to open the loop, whereupon the arms *A* may be swung clear of the arms *C*, as shown by dotted lines in the engraving.



ICE TONGS WITH WEIGHING ATTACHMENT.

SAFETY CLUTCH FOR ELEVATORS.

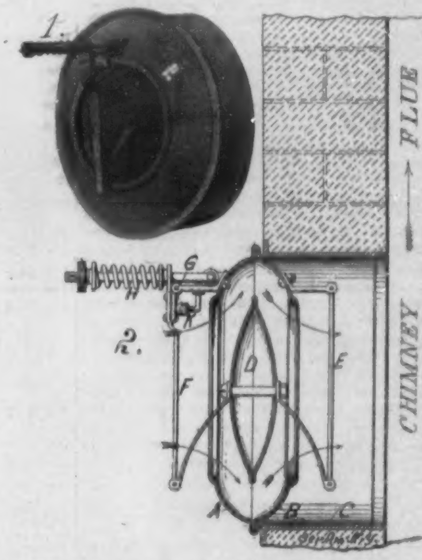
The accompanying engraving illustrates a simple form of clutch for passenger elevators, and also for mine cages, which will act instantly and automatically to stop the car the moment the hoisting cable parts. The clutch will hold the car safely until the cable is repaired and draft tension is applied thereto, when it will automatically release. In the illustration the car is shown at *A* suspended between the guideways *B*. The latter are provided with the usual racks *C* adapted to be engaged by the clutch. Rails are mounted at each side of each rack, and guide shoes carried by the car engage these rails. Above the car is an auxiliary frame *D*, in which a draft bar *E* is mounted to slide. The lower end of this bar is connected by means of parallel links *F* with clutch members *G*, and a pair of arms *H* hinged to the top of the car are connected to the lower links *F*. The hoisting cable is attached to the draft bar *E* and as long as there is a draft strain on this cable the draft bar will be held in its raised position, as shown in the engraving, with a pin in the bar bearing against the auxiliary frame and supporting the weight of the car. When in this position the links *F* and *H* coact to hold the clutch members *G* in their inactive position. Should the cable break, a spring *K*, acting on the pin in the drawhead, would move the latter down and thereby force the clutch members *G* into engagement with the racks *C*. The parallel links *F* serve to hold the members *G* at all times parallel to the racks, and owing to the toggle motion of the links *H* and *F*, a strong, positive action is provided. The device can be adjusted to any type of elevator shaft. Mr. Marvin C. Hutchings, of Bozeman, Montana (Box 28), is the inventor of this clutch.



SAFETY CLUTCH FOR ELEVATORS.

AN IMPROVED DRAFT REGULATOR AND VENTILATOR.

A draft regulator has recently been invented which is also adapted for use as a ventilator for inclosed places. The device is automatic in operation for either function and is very sensitive, so that it will work efficiently under varying conditions of service. The device comprises a shell formed of two sections *A* and *B*, which are essentially concavo-convex, and each section is formed with a large opening in the side. A sleeve *C* projects from one side of the shell, and is adapted to fit into an opening in the chimney or ventilating flue. Mounted centrally within the shell is a damper *D* of double convex form. This damper is supported in place by means of spring arms attached to the opposite plates *E* and *F*. The latter plate is fulcrumed at *G* on a bracket fastened to the section *A*. A spring *H* bears against the shorter arm of the plate *F* with a tension which may be adjusted by means of a thumb nut. A buffer *K* is pivoted to the bracket on which the arm *F* is fulcrumed in such manner that it may be moved into or out of engagement with this arm whenever desired. When the device is used as a draft regulator, the buffer *K* is moved to such position as to bear against the arm *F* when the damper *D* is centrally disposed in the shell. The spring *H* is then adjusted so as to draw the damper against the opening in the chimney in the section *A* of the casing. Now, if the draft in the chimney is increased by variable wind currents, the damper will be moved away from the section *A*, uncovering the opening therein in a degree proportional to the change of draft, and permit the air to enter the chimney without passing through the fire.

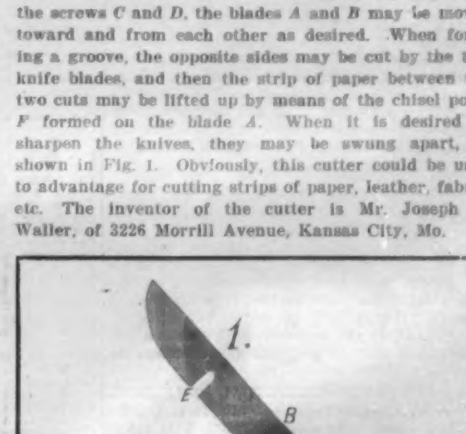


AN IMPROVED DRAFT REGULATOR AND VENTILATOR.

When used as a ventilator, the buffer *K* is moved out of active position, and the spring *H* is adjusted to hold the damper centrally in the shell. When the draft increases, the damper will close the opening in the section *B*. In case the draft becomes reversed, the damper will close the opening in the section *A* and prevent the entrance of foul air from some other room. The inventor of this device is Mr. Jonathan W. Noxon, of 519 Helena Avenue, Valley City, North Dakota.

CUTTING TOOL FOR USE IN MAKING PAPER BOXES.

In the manufacture of boxes, cartons, and the like, a make ready is employed which consists of a sheet of pressboard glued on a brass or steel faceplate. In making a fold or in binding a corner of the box, a groove in the pressboard is used as a guide. Unless the slots or grooves in the make ready have absolutely parallel sides, there is danger of cutting the paper which is being creased, or of imperfectly folding the same. To permit of cutting the grooves with the desired degree of accuracy, the tool shown in the accompanying engraving has been invented. Two blades, *A* and *B*, are provided, and these are formed with sharpened ends, as shown in Fig. 2. Threaded into the blade *B* is a thumbscrew *D* formed with a reduced threaded end, which passes through an aperture in blade *A*. A thumb nut clamps the blade against a washer on the screw *D*. Near the sharp ends of the blades is a second thumb screw *C*, which is threaded through blade *A*, and has a reduced portion adapted to pass through the recess *E* of blade *B*. A thumb nut serves to clamp the blade *B* against the shoulder formed on the screw *C*. By adjusting the screws *C* and *D*, the blades *A* and *B* may be moved toward and from each other as desired. When forming a groove, the opposite sides may be cut by the two knife blades, and then the strip of paper between the two cuts may be lifted up by means of the chisel point *F* formed on the blade *A*. When it is desired to sharpen the knives, they may be swung apart, as shown in Fig. 1. Obviously, this cutter could be used to advantage for cutting strips of paper, leather, fabric, etc. The inventor of the cutter is Mr. Joseph B. Waller, of 3226 Morrill Avenue, Kansas City, Mo.



CUTTING TOOL FOR USE IN MAKING PAPER BOXES.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

INSULATOR FOR HEAVY CONDUCTORS.—L. STEINBERGER, New York, N. Y. Among other objects of this inventor are: To provide a substantially saddle-shaped insulator, practically in one piece. Means for securing the insulator to the rail and readily detaching the same therefrom. Means for facilitating the vertical movement of the track structure independently of the rail, thus allowing for depression of cross ties and track without disturbing the third rail. To provide a support for the insulator having a hood portion for protecting the insulator from the weather and mechanical injury.

AUTOMATIC ELECTRIC SWITCH.—M. MINTZ, Rock Island, Ill. The invention relates to switches adapted for automatically opening or closing an electric circuit, and has for its object means peculiar in nature, employing fixed and movable contacts, and means whereby to accelerate circuit closing action, of the movable contact over movement imparted thereto by the switch opening means.

TROLLEY.—A. W. HUHSMAN, Staunton, Ill. This trolley improvement prevents the accidental separation of the trolley-wheel from the overhead conductor during the travel of the car, but admitting of the ready passage of the trolley past the conductor hangers. To this end one embodiment of the invention consists of spring-pressed T-shaped members having opposed projections or cams passing over the top of the trolley-wheel, and provided with depending outwardly-turned portions to which the trolley rope is connected.

Of General Interest.

GRAVITY SIGNAL-BELL.—J. McK. CHAMBERS, Boulder, Col. The invention refers to signal bells and more specifically to bells of this type which are adapted to be located at a distance from the operator. The bell is positively operated and it will be impossible for the operator to sound the bell more than once upon each releasing of its hammer.

Hardware.

TONGS.—W. E. WERD, Deer Lodge, Mont. The purpose here is to provide a tool handle adapted for use in connection with any type of gripping members, as for example, the confining members of hand cuffs, the arms of ice tongs, the engaging arms of log dogs, etc. Means provide for locking the gripping members in closed position and for separating them, and to so construct the handle that a firm grip can be maintained thereon, and wherein the more it is subjected to tension the greater will be the gripping action of the gripping members.

REPAIR-TOOL.—W. L. DINSMOOR, Longbeach, Cal. The improvement is in a tool more especially designed for the use of automobilists in making tire and other repairs while on the road. The inventor's purpose is to provide either a vise or a clamp, as desired, one of which is employed to hold the other in operative position while in use.

Heating and Lighting.

HEATING ATTACHMENT FOR GRATES AND FIRE-PLACES.—F. A. DELPH, New Orleans, La. The present invention is embodied in an attachment for the fireplace, or grate frame, the same consisting of a supplemental frame to which the plate having the heating flues or pipes attached is hinged so as to swing laterally thereon. It is an improvement upon that for which Mr. Delph formerly filed an application for patent.

HEATER.—W. H. CALLIHAN, Beaumont, Tex. The invention relates to heaters using crude oil or other hydro-carbon oil as fuel, and its object is to provide a stove or heater more especially designed for heating rooms and the like, and arranged to insure combustion, to produce a uniform heat at a minimum expenditure of liquid fuel, and to prevent the escape of obnoxious gases, soot, and the like into the room where the heater is located.

Machines and Mechanical Devices.

REGISTERING DEVICE.—R. HUNTER, Atlanta, Ga. One purpose of the inventor is to provide a device especially adapted for temporarily holding linen or laundry work and for registering the number of pieces held by the machine. As each article is introduced a record thereof will be automatically established. They can be conveniently released and simultaneously the recording mechanism be brought to the zero mark.

MECHANICAL PERPETUAL CALENDAR.—J. S. HEITHERSAY, 59 South Terrace, Adelaide, South Australia, Australia. This calendar consists of three plates or disks united by a central pivot pin, all of the plates or disks carrying printed matter and the upper two being provided with openings through which certain of the matter on those behind can be read. The calendar may be made to apply to any number of years without alteration to the main plate and front rotatable disk.

Prime Movers.

TURBINE-ENGINE.—R. J. SCHLOMING, New York, N. Y. The object here is to provide means for reversing a single shaft turbine directly, without changing the direction of flow of the steam or other propelling fluid, and without altering the relative position, pitch, or angle of the blades, and without the use of additional casings or rotary parts or disks with reversed blades, and without the duplication or addition of any of the parts of the ordinary direct acting turbine.

Pertaining to Recreation.

GAME APPARATUS.—F. WALLSTEIN, New York, N. Y. The object of the invention is to provide a new and improved game apparatus, more especially designed for playing chess, checkers, and like games in the open air, and arranged to afford considerable amusement to the players and the onlookers.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending February 4 1908.

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Acetylene generators, carbid feed for, A. S. Phelps, Jr. 878,310
Addressing machine, M. & J. Burke 878,117
Adjustable bracket, L. D. Carter 878,455
Advertising apparatus, C. A. & C. E. Yale 878,171
Advertising device, A. B. Mackie 878,301
Air brake, W. G. Pattee 878,468
Air compressor, electric, N. M. Watson 878,260
Amusement device, F. J. Johnston 878,400
Animal trap, T. J. Crump 878,123
Annealing furnace, wire, H. B. Humphrey 878,290
Annular knife, E. G. Hoffmann 877,927
Apparel, wearing, J. A. Sullivan 877,964
Arch supporter, C. E. Bullard 878,039
Assembling apparatus, J. R. Brown 877,900
Automobile driving gear, J. E. Johnson 878,005
Automobile running gear, C. T. Pratt 878,156
Automobile transmission gear, J. W. Lambert 878,072
Awning, porch, C. Frantz 878,284
Bag holder, Z. R. Brown 878,336
Baler, hay, R. E. Zimmerman 878,445
Baling device, G. N. Campbell 878,342
Baling machine, broom corn, C. K. Miller 877,939
Baling press indicator, C. A. Whitehorn 878,169
Bar. See Boring bar.
Barber's check system, C. L. Derr 878,193
Barley, preparing, J. A. Caverhill 878,189
Bearings, automatic lubricator for shaft, J. R. Steiger 877,962
Bed, invalid or hoisting, J. J. Collins 878,045
Beet topper, C. L. Winterburn 877,975
Bellows, hand, Fecker & Jelleff 878,367
Binder, loose leaf, A. Dom 878,281
Binder, temporary, H. F. Bushong 878,340
Biscuit, machine for manufacturing cereal, H. D. Perky 878,154
Bit stock, I. Larson 878,404
Boards, manufacture of cellular, S. M. Langston 878,403
Boats, feathering paddle attachment for small, W. Rickards 878,460
Boiler tube, W. A. Compton 878,353
Boiler tube cleaner, R. O. Hodge 878,286
Bolt, M. Jacobs 878,003
Bolt for desks and other structures, C. E. Johnson 878,206
Book, account, W. T. MacDougall ..878,216, 878,217
Boring bar, C. L. Riker, Jr. 877,950
Bottle holder, ink, W. S. Paulson 878,233
Bottle stopper, J. S. Alston 878,175
Bottle stopper, water, Kraft & Schweinert 877,933
Brace, G. M. D. Heard 878,205
Brake applying mechanism, J. M. Hines 878,065
Brew house equipment, M. Henius 878,136
Brooms and the like, holder for, W. Jones 878,068
Brush, H. V. Hardman 878,134
Brush holder, R. Febler 877,990
Brush, tooth, W. N. Taylor 878,164
Brush, tooth, L. H. Crowell 878,486
Brushes and brooms, manufacture of, P. Chazal 878,343
Brushes, manufacture of, P. Chazal 878,344
Brushes, scrubbers, and the like, device for fastening the handles in, A. Eisel 878,282
Buckle, J. S. Sourek 877,958
Buckle, E. N. Humphrey 878,288
Buckle for webbing, F. A. & J. B. Russ 878,090
Buckle, harness, I. Sellers 878,318
Button, T. J. McGovern 878,149
Cabinet, S. D. Newman 878,228
Cable or rope, G. Magaldi 878,407
Calculating machine, Johanson & Hultman 878,292
Calculating machine, A. Muller 878,413
Camera, photographic, L. M. Sternbergh 878,250
Can opener, G. K. Winchenbach 877,974
Can spout, W. McAdoo 878,304
Cans, casks, etc., carrier for, J. Cummings 878,358
Car, E. A. Barber 878,180
Car, E. S. Bucknam 878,338
Car door, grain, M. Reid 878,019
Car friction draft gear, railway, A. Stucki 878,321
Car heating system, E. E. Gold 878,479
Car motor mounting, street, E. A. Barber 878,179
Car mover, V. Gusztav 878,381
Car rack, J. B. Foley 878,198
Car replacer, H. E. & W. P. Matthews 878,409
Car, single truck, E. A. Barber 878,181
Car stake, F. W. Lawrence 878,405
Cars, portable automatic stop mechanism for, P. Winsor 878,263
Carbureter, L. M. J. C. Levavasseur 878,297
Carbureter for internal combustion engines, O. Minton 878,411
Carbureters, cushioning device for automatic dilution valves in, A. A. Longuemare 878,077
Card shuffler and trump indicator, playing, J. Gaunt 877,992
Carding machine cylinder and clothing therefor, C. A. Cobbett 878,348
Carpet sweeper, T. L. Totten 878,432
Cart, dumping, B. F. Brown 878,115
Cartridge, G. A. Finster 878,369
Cashier and discount machine, automatic, C. E. Yale 878,173
Casing head, D. K. Johnston 878,067
Cast iron and the like, hardening of, G. H. H. Emett 878,053
Caster, W. B. Rand 877,948
Casting machine, A. L. Walker 878,102
Cement compound, composition of matter to be used as a, C. Guy 878,382
Cement mixing machine, F. J. Emal 877,918
Centrifugal machine, L. Fuchs 877,991
Chain and bead stock, jeweller's, J. Costello 878,122
Chain, door, J. Kleidmann 878,294
Chair. See Rail chair.
Chair, J. E. Baker 878,267
Chairs, mirror attachment for, C. I. Thompson 878,255
Check protector, N. B. Rice 878,021
Check protector, D. H. Cohen 878,349
Churn, aerating, E. H. Burnes 878,339
Chute, grain, A. G. Young 878,443
Cigar clipper, M. Bixby 878,110
Cigar tip cutter and lighter, combined, T. P. Moody 878,082
Clarinet, H. Bonn, Jr. 878,333
Cleaning apparatus, suction, Baumann & Seyboth 878,109
Clock, alarm, Stockton & Porter 878,251
Clock, alarm, E. E. Gage 878,371
Clock and watch, J. Lichtenstein 878,076
Clothes drying reel, W. J. Coulter 877,985
Clothes line prop, D. McDougall ...878,415, 878,416
Clothes line reel, L. Holle 878,394
Clothes line support, H. Morris 877,941
Clothes pounder, H. L. Crooker 878,190
Clutch, O. Anderson 878,177
Cocks, self-locking attachment for angle, W. C. Feighan 878,368
Coffee or tea percolator, F. Geissler 878,374
Coffee or tea pot, I. J. Webster 877,973
Coil windings, reel for, I. De Kaiser 878,125
Coin controlled apparatus, percentage mechanism for, C. E. Yale 878,172
Coin receptacle, E. W. Roberts 877,951
Collar supporter, A. Illoway 877,928
Commutator cover, J. E. Webster 878,167
Computing machine, A. S. Dennis, reissue. 12,748
Concentrator, J. E. Doggwyler 878,363
Concrete building block wall, F. M. Henry, 877,996, 877,997
Concrete walls and the like, means for use in building, R. W. Pommerer 878,155
Conveyer, F. R. Willson, Jr. 878,170
Conveyer, cable hoist, B. C. Riblet 878,157
Cop making apparatus, J. Scharer-Nussbaumer 878,091
Cop tube, S. W. Wardwell 878,104
Corn husker, J. W. Ertz 878,365
Corn shellers, cob gate for, A. H. & H. A. Berns 878,037
Corn tree, seed, J. C. Blackford 878,271
Corset, M. Bachura 877,978
Corset, J. Cohen 878,351
Corset, E. Abadie-Leotard 878,446
Cot and pack sack, convertible, Forsell & Ekroot 878,055
Cotton chopper, S. W. Jackson 878,066
Cotton chopper, G. B. Gauntt 878,373
Cotton gin feed attachment, C. B. P. Carver 878,188
Cotton scrape, C. R. Bowen, Jr. 877,899
Counter protecting device for stores, etc., J. B. Monette 878,147
Coupling head, steam, B. F. Hudson 878,001
Culinary boiler or steamer, A. B. Rice 878,020
Culm, sectional, J. S. Wilson 878,441
Cultivator, C. W. Gibbs 878,375
Cultivator, power, C. Edwards 877,988
Curd mill, J. Brouwers 878,114
Currycomb, Tunstall & Sicotte 878,433
Curtain bracket and shade roller support, F. Adams 878,448
Curtain fixture, H. K. Meis 878,410
Cutlery washing machine, W. E. Merrell 878,010
Dam, shell, E. B. Jennings 878,291
Dish drainer, G. Samso 878,315
Displaying articles of merchandise, means for, W. O'Sullivan 878,307
Door check and lock, safety, Franeek & Dytrych 878,056
Door covering, metallic, E. B. Gager 877,922
Door, grain, W. S. Driskell 878,050
Door hanger, P. F. Holsters 878,395
Doors, walls, and the like, spying aperture for, J. Shackley 878,245
Draft equalizer, J. Van Matre 878,027
Driving mechanism, friction clutch, J. A. Firsching 878,458
Drying fabrics or fibrous material, apparatus for, A. N. Marr 877,938
Dust collecting apparatus, G. R. Bimm 878,329
Dust collector, W. A. Derby 878,126
Dyeing and other machines, hoisting apparatus for, J. Hussong 878,399
Dyeing bobbins and the like, machine for, C. Wansleben 878,103
Electric alarm operated by alarm clocks, E. Ploudre 878,087
Electric car lighting, means for mounting and driving dynamos for, McGary & Jepson 878,305
Electric charges, conductor for discharging high voltage, W. H. Chapman 878,272
Electric contact, overhead, T. W. Small 878,247
Electric machine, dynamo, E. M. Tingley 878,165
Electric supervisory and signaling system, automatic, J. G. Nolen 878,012
Electrical contact device, F. Fink 877,919
Electricity, neutralizing static, W. H. Chapman 878,273
Electrolytic apparatus for electrolysis of metallic salts, W. H. Rines 878,425
Embroidered web, appliance for severing, A. Bosshard 878,111
Engine, J. Copeland 877,910
Engine attachment, hoisting, H. Maker 878,218
Engine casing or frame, gas, Miller & Rakestraw 878,466
Engines, electric sparking device for gas, E. R. Moffitt 878,412
Engines, lubricant distributer for, V. Lancia 878,073
Envelop and letter sheet, combined, W. A. Pridmore 878,234
Evener, T. Kretuz 878,209
Excavator, Greer & Thompson 878,460
Explosion engine, C. L. Edwards 878,364
Extension table, F. J. Seng 878,093
Eyeglass nose guard, D. F. Green 877,994
Feed bag, foldable, T. Clish 878,120
Feed trough, L. Z. Pearson 878,086
File and punch, paper, C. Spiro 878,320
Filling tube for liquids, A. Schneider, 878,241, 878,243
Filling tube for liquids, sealing head for, A. Schneider 878,242
Finish remover, P. J. Ryan 878,240
Fire extinguisher, Hyde & Peterson 878,487
Fireplace screen, C. E. Mitchell 877,940
Fireproof building construction, C. Collins, 878,275, 878,276
Fireproof shutter, J. Cahill 878,341
Fish line float, J. S. Denning 878,362
Fish scaling and cleaning machine, G. P. Yeakel 878,174
Flag signal and case, locomotive, J. P. Lyon 877,935
Floor finishing apparatus, N. D. S. K. Beck 878,269
Fluid pressure brake system, G. M. Spencer 877,959
Flush tank, O. J. Fabian, reissue 12,747
Fly catcher, H. A. Kessler 878,207
Fly catcher, F. Bayer 878,268
Folder and mailing case therefor, view, M. Witt 878,325
Fountain. See Soda water fountain.
Fraud detecting and preventing means and method, E. A. Evans 878,366
Friction coupling, cone, H. Baumgartner-Mica 878,035
Fuel manufacturing apparatus, P. Hoering 878,480
Furnace grate, Sieben & Danhoff 878,246
Furnaces, reversing valve for regenerative, J. B. Nau 878,306
Fuse, electric, S. J. Leveen 878,212
Gage and circuit closer, combined, J. F. Raynes 878,423
Gage for carpenters' rules, etc., R. R. Lea 877,934
Game apparatus, Pell & Clark 878,309
Game apparatus, S. D. Bowers 878,334
Garment, combination, M. E. Rogers 878,237
Garment supporter, M. Hirsch 878,137
Garter, B. E. Paneth 878,084
Gas burners, globe holder for, W. Livingstone 878,299
Gas generators, apparatus for feeding fuel to, C. F. Cattell 877,905
Gas pressure regulating device, T. B. Keogh 877,932
Gases, apparatus and process for burning acetylene or similar, J. Harris 878,461
Gate, W. S. Flick 877,920
Gear, reversing, F. G. Gies 878,132
Generator. See Steam generator.
Glass pressing and blowing machine, A. W. Beeson ..... 877,[illegible]81
Glassware, apparatus for fire finishing, R. Haley ..... 877,[illegible]23
Gold leaf and the like, apparatus for applying ribbon, G. Braunlein ..... 878,1[illegible]4
Golf ball, W. Taylor ..... 878,[illegible]84
Governor, Glocker & White ..... 878,[illegible]7
Governor and valve movement, G. Wolke 878,105
Grader and excavator, W. F. Fink ..... 878,[illegible]3
Grain drying and cooling machine, S. J. McCarthy ..... 877,[illegible]2
Grain tank and elevator, J. W. Tobin ..... 878,[illegible]8
Grinding machine, shear, G. Wieber ..... 878,[illegible]
Guard device, A. S. Josephs ..... 878,[illegible]9
Gun carriage, field, Dawson & Buckham ..... 878,[illegible]9
Hacksaw, W. M. Stebbins ..... 878,1[illegible]
Hair dyer, L. Stafford ..... 877,[illegible]
Hair pin attachment, C. Hartman ..... 878,[illegible]
Hair spring gage, watchmaker's, E. Clark ..... 878,3[illegible]6
Hanger. See Door hanger.
Harness hook, H. Greenland ..... 878,3[illegible]
Harness, shoeing, W. M. Clement ..... 878,3[illegible]7
Harvester, corn, R. B. Brewer ..... 878,4[illegible]7
Harvester, flax, J. H. Philipp ..... 878,3[illegible]1
Harvester, potato, F. W. Heimberger ..... 878,2[illegible]5
Hasp lock, G. F. Darracott ..... 878,0[illegible]7
Hat, lady's and child's, K. E. Mann ..... 878,2[illegible]9
Heat transference, C. R. Butler ..... 877,9[illegible]
Heaters, apparatus for cleaning water, G. J. Dehn ..... 878,2[illegible]
Heating and ventilating system, W. R. Macdonald ..... 877,9[illegible]
Hoe, surface, J. A. Crummer ..... 877,9[illegible]
Hoist, E. Y. Moore ..... 878,2[illegible]6
Hoisting and conveying device, Miller & Dickinson ..... 878,4[illegible]2
Hoisting apparatus, A. P. Boyer ..... 878,3[illegible]5
Hook and eye, Knobloch & Burget 878,464
Horse releaser, Sinclair & Leslie 878,319
Horse releaser, A. White 878,323
Horseshoe, J. P. Detwiler 878,127
Horseshoeing stall, L. Pendleton 877,947
Hose supporter clasp, J. Cohen 878,350
Hot air register, S. Tuttle 878,257
Hot water heater, J. A. & E. W. Coppridge 878,356
Hub attaching device, S. Gnagy 878,200
Hub banding machine, O. A. Frick 878,131
Hydrocarbon burner, S. W. Bates ..877,897, 877,898
Ice creeper, A. B. Johnson 877,929
Ice harvesting machine, T. Diamond 877,916
Ice machine compressor, C. W. Miles 878,483
Induction coil, R. Varley 878,435
Induction coil system, I. C. Orswell 878,467
Inhaler, A. F. Meisselbach 878,223
Ink well, A. Gailey 878,372
Inking pad, D. T. O'Sullivan 878,420
Insole, N. C. Bohr 878,453
Insulator, H. R. Markel 878,302
Irrigator, electrolytic, P. Del Gaudio 878,361
Joint device, expansion, F. Seiffert 878,317
Journal bearing, F. L. Adams 878,031
Journal box, car axle, C. T. Arnold 878,328
Journal box for road and other vehicles, J. E. Cooper 878,355
Key, O. Katzenberger 877,930
Key ring device, Clark & Cookson 878,274
Keyboard, Cross & Umberger 877,911
Knee rest, H. M. Landfield 878,008
Knife. See Annular knife.
Lace and tongue stay, shoe, H. Downer 878,129
Ladder, collapsible, W. J. Blundell 878,332
Ladle carrier, Imboden & Lawlor 878,002
Lamp, A. L. Glaentzer 878,376
Lamp burner, J. A. Heisabeck 878,063
Lamp, gas, A. H. Humphrey 878,397, 878,398
Lamps, manufacturing incandescent bodies for electric, Just & Hanaman 878,463
Lantern, hand signaling, E. M. Tomlinson 878,431
Last, S. M. Hamblin 877,995
Lathes, model or guide wheel for, D. K. Barry 877,979
Leather, manufactured, A. W. Case 878,485
Light box, C. M. Olin 878,418
Lithographic stone, cemented, H. Wagner 878,322
Load binder, T. Barnes 878,034
Lock and sealing device, G. H. Maas 878,215
Loom for weaving tufted fabrics, J. A. Clark 878,119
Loom shuttle motion, M. Moul 878,148
Loom, weft replenishing, W. H. Brothers 878,337
Magnet for alternating currents, C. Kramer 878,402
Mail bag catching and delivering apparatus, J. C. Dayton 878,360
Mail box, N. Saltonstall 877,952
Mail box signal, T. G. Brown 878,036
Maps in colors and in relief, manufacture of, A. Patesson 878,308
Marking device, F. J. Kadan 878,293
Massage apparatus, vibratory, G. R. Macomber 878,078
Match box, magazine feed, L. Hamill 878,059
Mausoleum, etc., non-condensing and storm proof, T. J. Moore 878,303
Measuring and gaging tool, A. Wagniere 878,439
Measuring device, skirt, M. C. Hammond 878,383
Mechanical movement, E. G. Eberhardt 878,051
Metal hardening apparatus, L. E. Curtis 878,279
Metal turning mechanism, J. Hartness 878,203
Milker, cow, J. M. Mattis 878,222
Milkers, self adjusting belt for cow, F. B. Groff 878,058
Mining, J. Kirschniok 878,208
Mirror attachment, T. E. Sutton 878,098
Molding machine, F. Herbert 878,064
Molding machine, sand, J. J. Chipchase 878,345
Mop and brush making machine, E. Koelln 878,295
Motor, F. C. Axtell 877,977
Music box, E. P. Riessner 878,088
Musical instrument, mechanical, McTammany & Ford 878,150
Musical instrument, stringed, P. Johnson 878,006
Nut lock, W. Chesterman 878,042
Nut lock, F. M. Volk 878,258
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Remedy for rheumatism, B. F. Snyder 67,423
Resilient composition, certain, Elastro Manufacturing Co. 67,489
Rubber boots and shoes, Lycoming Rubber Co. 67,437
Rubber boots and shoes, American Rubber Co. 67,453, 67,454
Rubber boots and shoes, Boston Rubber Shoe Co. 67,457, 67,458
Rubber boots and shoes, Goodyear's India Rubber Glove Mfg. Co. 67,462
Rubber boots and shoes, Joseph Banigan Rubber Co. 67,463, 67,464
Rubber boots and shoes, Lycoming Rubber Co. 67,466, 67,467
Rubber boots and shoes, Meyer Rubber Co. . 67,468
Rubber boots and shoes, New Brunswick Rubber Co. 67,469
Rubber boots and shoes, United States Rubber Co. 67,472
Rubber goods, certain, Geo. Borgfeldt & Co. 67,431
Rubber toys, Geo. Borgfeldt & Co. 67,512
Sardines, Globe Packing Co. 67,432, 67,433
Shoes, leather, E. A. Quirl 67,503
Silk piece goods, Valentine & Bentley Silk Co. 67,404
Sinks, stone, Norcross Co. 67,401
Soap, N. K. Fairbank Co. 67,516
Soap for laundry and household use, Hunt Bros. Soap Co. 67,528
Soda water syrup, Maas & Waldstein Extract Co. 67,399
Spectacles and eyeglasses, J. A. Pfeifer 67,518
Stethoscopes, P. A. Aurness 67,455
Tobacco, cigars, cigarettes, and cheroots, C. C. Bogart 67,525
Toilet preparations, certain, A. G. Baumgarten 67,507, 67,510
Tonic, scalp, Knowlton Danderine Co. 67,416
Tracing cloth, L. & C. Hardtmuth 67,436
Truss pads, Chesterman & Streeter 67,459
Typewriting machines, J. W. Bamberger & Co. 67,456
Vegetable compounds, certain, E. P. Siccardi 67,422
Veilings, netted, Steiner, Rosenstein & Traub 67,537
Vinegar and canned fruits and vegetables, Ridenour Baker Grocery Co. 67,444
Water heaters and tanks, certain, Kellogg-Mackay-Cameron Co. 67,479
Waters, mineral, carbonated, and aerated, Glenn Springs Co. 67,397
Waters, table, J. Ries 67,402
Whips, Cargill, Cleveland & Co. 67,429
Whisky, Elder-Harrison Co. 67,511
Whisky, Crigler & Crigler 67,526
Whisky, Bourbon and rye, Golden State Wine Co. 67,446
Wrenches and pliers, Crescent Tool Co. 67,460

LABELS.

"Auto Girl," for candy, National Candy Co. 14,023
"Don Gusto," for cigars, A. C. Henschel & Co. 14,022
"Ferro-China Marion," for medicine, Mariani Bros. 14,028
"Gypsy Queen," for cigars, C. Schweitzer .. 14,020
"Kant Steam," for a preparation to prevent steaming or blurring of eyeglasses in cold weather, Kant Steam Chemical Co. 14,032
"Listerated Pepsin Gum," for chewing gum, Common Sense Gum Co. 14,026
"Litch's Hygienic Bath," for liniment, L. W. Litch 14,031
"Maltese Cross Brand," for raisins, W. Pike 14,024
"Neurotunder," for local anesthetics, Kreoden Mfg. Co. 14,030
"Olde English Mince," for mince, Oliver Bros. 14,025
"Rajah Del Durbar," for cigars, R. Loughlin 14,021
"Scheur's Nevo-Fado, The 'Rite' Ink," for writing ink, Scheur Bros. 14,033
"The All-Ways Safety Razor," for safety razors, Automatic Utilities Co. 14,034
"Thor-ax-ine," for medicine, Laxacura Chemical Co. 14,029
"Trigg's Hand Wash," for a hand and face lotion, Dr. F. M. Trigg 14,027
"Ye Old Colonials," for rugs and carpets, J. V. Mawby 14,035

PRINTS.

"Precious and Semi-Precious Stones and Where Found," for precious and semi-precious stones, Maxwell & Berlet, Inc. . 2,210
"Rivets, Washers and Sheet-Metal Specialties," for rivets, washers, eyelets, and metal specialties, Edwin B. Stimpson Co. 2,209
"The Power Behind the Cook," for flour, Washburn-Crosby Co. 2,208

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York,